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Theory of Engineering Structures.

Reviewed by LEWIS E. MOORE,* Assoc. M. Am. Soc. C. E.

KINETIC THEORY OF ENGINEERING STRUCTURES.—Dealing with Stresses, Deformations and Work for the Use of Students and Practitioners in Civil Engineering. By David A. Molitor, B. C. E., C. E.; M. Am. Soc. C. E.; Professor in Civil Engineering, Cornell University. New York and London: McGraw-Hill Book Co. Cloth; 7 × 9½ ins.; pp. 366; numerous text illustrations and tables. $5, net.

The are many American text-books on statically determinate structures practically all of which are devoted to methods of finding stresses in different trusses. Many of them give approximate methods of solving certain indeterminate structures, but in the majority of cases these methods are based on assumptions which may or may not be correct and the reader is, as a rule, left in the dark as to how close to the exact truth he may reasonably expect to come by applying these assumptions. Recently American authors have turned their attention to setting forth more exact solutions of the problems involved in statically indeterminate structures with the result that several books have been recently published or are now in press which deal to a greater or less extent with this type of construction. The awakening of interest in structures of this class in this country is contemporary with indications of the revival of the use of such structures in engineering work. The practicing engineers of some thirty years back made considerable use of this general type of structure. The discontinuance of its use seems to have been largely brought about by an undue emphasis on the value of statical determination, together with the use of unnecessarily poor details in such indeterminate trusses as were built.

At the present time the indeterminate truss, never out of favor in Europe, appears to be in a fair way to regain some of its former popularity in this country.

The volume under consideration deals largely with indeterminate structures and is extremely mathematical in its character. With reference to its rather unusual name the author explains that he uses the term kinetic because any "bridge or other structure composed of elastic material ceases to be at rest the moment it is acted upon by external forces" and therefore the distinction between a bridge and a flywheel, for instance, is only relative. It would seem that a name whose justification requires nearly a page of print cannot be altogether apropos.

The book presupposes a thorough knowledge on the part of the reader of "higher mathematics, including the calculus; also, of the elements of statics, embracing the composition and resolution of forces, force and equilibrium polygons, etc." It also tacitly assumes a much greater ability to apply the principles of mechanics intelligently than is possessed by most students.

The first chapter is headed "Reaction and Redundant Conditions" and gives a method of determining whether or not a structure is externally statically determinate by finding how many "stability conditions" are supplied by the supports. Forces are then substituted for these "stability conditions" and if more than three forces are required the reactions are not determinate, etc. It would be far simpler, surer, and less confusing to state that there is one force at each point of support and that each of these forces has three properties, magnitude, direction, and point of application; and then to determine by inspection how many of these properties are known from the construction, thus arriving by a method of elimination at the number of unknown quantities involved in the reactions. The conditions of internal statical determination are treated, but not in the simplest way.

Chapter II. deals with theorems, laws, and formulas for framed structures, taking up first the fundamental equations for elastic deformations, and then developing the general work equations and Clapeyron's law for the work of deformation. The law of virtual work is followed by Prof. Mohrs' work equations, after which the general case of displacement of points in statically determinate trusses is treated. The rest of this chapter is devoted to indeterminate structures, abutment displacements and temperature stresses by Mohrs' equations, Maxwell's, Menabreas' and Castigliano's laws. The following statement of Castigliano's law is not as clear as it should be, "the path δ of a load P is equal to the partial differential derivative of the actual work of the frame with respect to P." The word "path" in this connection is totally misleading and "differential derivative" is certainly tautological. Contrast this with the clearness of the statement in Church's book on mechanics of internal work: "In any structure of elastic bars . . . the first differential coefficient of the total internal work with respect to any one of the external forces is equal to the displacement of the point of application of that force in the direction of the force." Important and difficult of comprehension as the fundamental equations dealt with in this chapter are there are only ten figures occurring in four of the twelve articles to illustrate the 59 equations derived.

Chapter III. contains theorems, laws, and formulas for isotropic solids, beginning with general work equations and taking up work of deformation due to shearing stress, followed by work of deformation for any indeterminate straight beam and closing the chapter with an article on work of deformation due to dynamic impact.

Chapters IV. and V. are devoted to influence lines. In connection with the definitions of these chapters it seems that the use of either of the commonly-accepted terms "neutral" or "critical point" to indicate that point of an influence line the ordinates to which on either side are of opposite signs would have been preferable to the term "load divide" used by the author. The method given for finding this "load divide" in a panel for stresses in web members is particularly simple, convenient, and easy to remember.

The article which treats of "absolute maximum moment" is needlessly verbose and might be misleading to one who approached it with no previous knowledge of that particular point. The author finds it for some point n and then proceeds to place a load at that point after finding that the center of the span should be half-way between that point and the resultant of the loads on the span. This is very misleading as it gives the impression that n is already located, whereas the very essence of the absolute maximum moment proposition is that not only is the location of loads for that moment unknown to start with but the point itself at which the moment occurs is also unknown.

Chapter V. deals with "special applications of influence lines to statically determinate structures," and begins at once with double intersection trusses, which are of course statically indeterminate, and states at the beginning that "usually trusses of this type are analyzed as two separate systems, dividing the loads between them in such a manner as may seem most probable." This method of treatment, while it is common practice, seems entirely out of place in a volume which professes to deal with "'higher structures' requiring more than the ordinary methods of statics for their analysis." Influence lines for cantilevers, three-hinged arches and for a skew plate girder for double track follow, and the chapter closes by showing certain influence lines for trusses with subdivided panels.

Chapter VI. treats of the distortion of a statically determinate frame by graphical methods, taking up the well-known Williott diagram together with its correction by means of Mohrs' rotation diagram. The application of these diagrams is illustrated by problems. Chapter VII. treats the subject of deflection of polygons for statically determinate structures by analytics and graphics for both horizontal and vertical deflections. Chapter VIII. treats of influence lines for elastic displacements and certain special applications of the same.

Chapter IX. takes up influence lines for statically indeterminate structures. It shows that the ordinates to the influence line for any redundant member are a constant factor times the ordinates to the deflection polygon for the loaded chord for a conventional loading equal to unity applied to the principal system. The author defines the principal system as the structure with the redundant member replaced by the forces which it exerts. This method is then applied to certain problems and is further extended to structures having more than one redundant member.

Chapter X. treats of special applications of influence lines, one problem being the influence lines for reactions and for various chord members on a drawspan. The method given does not seem to have any advantage over the method of assuming that the moment of inertia of the truss is a constant and determining an influence table for reactions for a load unity at each panel point, by the theorem of three moments, making a tentative design on this basis and then determining accurately the reactions by the formula of Fraenkel or its modifications. The application of this method to various structures, such as two-hinged arches, together with computations for kernel points, etc., completes this chapter.

Chapter XI. takes up methods to be followed in designing statically indeterminate structures, giving means whereby an approximate design may be determined which will serve as a basis for a more complete solution of the

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problem in question. This method is illustrated by a problem. The proper selection of the redundant conditions to lead to a simple solution of a given problem is discussed, as well as the general case of redundancy, effect of temperature, shop lengths, and abutment displacements.

Chapter XII. treats stresses in statically determinate structures. The author states that:

> It should also be emphasized that all computations of stresses should err decidedly on the side of safety, since the secondary stresses produced by the friction on pin-connected joints are frequently a very considerable quantity, to say nothing of the failure to analyze properly the effect of the riveted connections.

This seems a dangerous doctrine to advance to undergraduate students as it encourages them to use an unformed and probably erroneous judgment and to arbitrarily increase sections, very probably in the wrong place, as well as to regard with more or less contempt accurate analysis. Properly it seems the suggestion should be advanced that the student should carefully study the effect of secondary stresses, in order that he might reduce them to a minimum or intelligently allow for them in his design.

Chapter XIII. treats secondary stresses, taking up effect of weight of members, eccentricity of connections, friction on pins, wind pressure, centrifugal force, impact, fatigue and unusual load effects. The chapter closes with a general statement concerning the features in design which should be observed in order to diminish secondary and additional stresses.

Chapter XIV. takes up the subject of mitering lock gates, devoting some 27 pages to this very special example of a structure.

The last chapter treats fixed masonry arches according to the theory of elasticity, determining approximate dimensions according to the formulas of Tolknitt. The author strongly advises the use of hinges in masonry arches.

As a whole the book seems to lay rather too much stress on the graphical methods of dealing with indeterminate structures at the expense of the analytical. Many engineers believe that the analytical method of dealing with such structures has many advantages over the graphical. Not the least of these advantages to the practicing engineer is the possibility of making the analytical computations with the help of persons who know nothing of the theory; a method of procedure which is probably impracticable when graphical methods are employed.

The figures are poorly executed, the lettering upon them being especially bad.

There is much very useful material in this book, but in the first portion, at least, considerable study and careful thought are necessary on the part of the reader in order to surely and correctly grasp the principles of the subject. The steps whereby the formulas are derived are not always made altogether clear nor are the assumptions made in such derivations always set forth with the clearness desirable in a work of this character. Quite often the derivation of an equation consists in setting down what each letter used in the equation stands for and then writing the equation with very meager explanation. Partly in consequence of this it does not appear to be a book which one could use for quick and ready reference. In this respect it is almost the antithesis of Church's small volume on least work, reviewed in these columns on April 13, 1911.

The usefulness of the book to the teacher would have been enhanced had the principles been emphasized more strongly and the formulas given less prominence. Nowhere in the book does the author illustrate or use the common and most useful "moment diagram" preferring rather to write out equations and substitute in them or to use graphical methods.

Perhaps the most noticeable departure from the text-book practice of the present time is the almost total absence of any illustrative problems in the first half of the book. It would seem that this useful aid in adjusting incorrect conceptions with regard to the theoretical demonstrations might have been very advantageously employed. In several places the book could have been simplified to great advantage.

Ewing on Steam and Heat Engines Brought Down to Date.

Reviewed by LIONEL S. MARKS,* M. Am. Soc. M. E.

THE STEAM-ENGINE AND OTHER HEAT-ENGINES.—By J. A. Ewing, C. B., LL. D., F. R. S., M. Inst. C. E., Honorary Fellow of King's College, Cambridge; Director of Naval Education. Third edition, revised and enlarged. Cambridge (England): The University Press. New York: G. P. Putnam's Sons. Cloth; 5½ × 8¾ ins.; pp. 604; 274 figures in text; one folding diagram in pocket; four tables. 15s., net; American price, $3.75, net.

An acceptable text-book may be written by any person of sufficient attainments who has a smattering of the subject and access to the literature; a good text-book can be written only by a master of his subject; but to write a really excellent text-book requires that the author should be not only a master of the subject but also a person of extended knowledge in other fields. At the time of the appearance of the first edition of his book in 1894, Dr. Ewing was professor of applied mechanics at the University of Cambridge and had already established his reputation as a writer of text-books by his work on Magnetic Induction, which, by its lucidity and thoroughness had become at once the standard work in the English language. The excellence of the book on "The Steam Engine" brought it immediate recognition both in English speaking and in foreign countries, and resulted in its translation into several languages. A second edition, with some revisions, appeared in 1897. Since that date the developments in heat engines have left this otherwise excellent work with several important deficiencies. The new, third, edition enlarges the previous book considerably and makes good the deficiencies in an adequate and satisfactory manner.

The particular excellence of this book, apart from the manner of presentation, is in the judicious selection of topics and the keen sense of relative values, which makes the book equally valuable both to the student who proposes to go no further in his study of the subject, and also to him, who, approaching the study of the heat engine in the "concentric" manner (to use the nomenclature of Professor Karapetoff) uses this book as the introduction to the subject. History, theory, construction, practice, design—all the different elements of a comprehensive treatment—are included, but without that excess in any one part which is the blemish of so many books on the subject. The author has escaped the common error of overloading the book with details of construction of pistons, crossheads and other built-up parts, which divert the mind of the student from the more fundamental ideas and substitute for them information of ephemeral or, often, of only historical value. If there is any suggestion of deviation from the admirable balance maintained in the former editions, it is in the selection of illustrative material which, following the elevation of Dr. Ewing to the position of Director of Naval Education of the Royal Navy, has a tendency to overemphasize the importance of marine engineering. It must not be forgotten, however, that this particular field for the application of heat engines is of relatively greater importance in Great Britain.

The opening chapter, which deals with the history of the steam engine, is but slightly changed from former editions and remains one of the best résumés of that subject that has been written. Particularly valuable is the quotation *in extenso* of Watt's own account of his experiments and of the reflections which led up to his first patent. It is a most stimulating document for the aspiring student. The following five chapters are devoted to the development of the theory of heat engines, and it is in this section particularly that the lucidity of the author and his art of exact but brief statement are best exemplified and are of greatest value. The difficulty which is experienced by the average beginner in grasping the elements of thermodynamics is largely due to the carelessness or to the dry formalism which characterize most of the texts on this subject; the clarity and interest of the present text make it both easy and pleasant reading.

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There are several important changes or tions in this section of the work. The autho adopted the steam tables of Dr. Mollier (publ in 1906 under the title "Neue Tabellen und gramme für Wasserdampf") which are upon a characteristic equation proposed by lendar and which fit the best experimental available five years ago, for temperatures 200° C. with notable accuracy. The advantage of these tables over all the pre tables lies in the consistency of the v amongst themselves, so that the relations w thermodynamic theory indicates as existing tween the various quantities in the steam ta do actually exist among the quantities tabul The degree of consistency which existed in earlier steam tables was sufficient for all ordinary purposes of the engineer, but the hi consistency of the Mollier tables adds to value for special purposes. Against this vantage must be balanced the probable i curacies indicated by the deviations of the t lated values from the best experimental va It is a question of individual judgment wh the values derived from a characteristic equ are on the whole superior to those derived rectly from experiment, but it is unfortu that in this case the characteristic equation not been modified so as to fit more accura the experimental data of the past five years. an example, the values of saturation pres calculated from the characteristic equation a fairly well with the old Regnault values but at all well with the new and undoubtedly more accurate Holborn & Henning values, as is shown in the following table:

Pressures of saturated steam in mm. of Mer

Tempera-ture, °C.	By Mollier's calculation from Callen-dar's equation.	By Regnault's measurements.	By Holborn and Henning measurements.
40°	54.9	54.91	55.13
50°	92.0	91.98	92.30
75°	288.5	288.5	289.0
130°	2030.0	2030.0	2025.6
160°	4651.0	4651.6	4633.
190°	9442.	9426.	9404.

At higher temperatures the error of the characteristic equation increases rapidly. A useful résumé of Callendar's method of deducing the various properties of steam from his characteristic equation is given in an appendix.

A welcome addition to the earlier chapters is the inclusion of the graphical methods of representing the properties of steam which were devised by Dr. Mollier. A large folded sheet, about 30 × 40 ins., contained in an envelope on the back cover, gives the two steam diagrams almost exactly as they appear in Dr. Mollier's book. Unfortunately, in this form, they are of little use to the student. They have not been converted into English units so that pressures remain in metric atmospheres (kgs. per sq. cm.) and volumes are in cubic meters. The specific volume lines are badly crowded for the lower pressures, so as to make the accurate use of the diagram impossible below atmospheric pressure. The scale of velocities, which is an extremely valuable feature of the diagram whenever turbine calculations are to be made, has been omitted. Altogether these large diagrams, which might have been so useful if properly prepared, have practically no value except for illustrative purposes.

The new chapter on steam turbines brings the book up to date in this important field and is admirably lucid and well balanced. The greater part of the chapter on oil and gas engines is also new and includes the Humphrey internal-combustion pump. Among other additions of importance may be mentioned a considerably enlarged discussion of the balancing of engines including multi-crank engines (following largely the method used by Dalby) and much new matter on boilers. Everywhere the aim of the author at "a reasoned rather than a descriptive treatment" is kept well in view and everywhere the dual aspects of the "heat engine" and of the "actual machines" are properly considered.

Ewing's book resembles the average English text-book rather than the American book. Its predecessors have generally been such works as that of Holmes, which covers the same field but

with the same faculty of illuminating the subject. The recent work of Ripper is more detailed and complete, but while it is extremely efficient and businesslike, it also fails to make the subject attractive. The American books which attempt to cover the same filed are not numerous and there are none of them to be compared in excellence with Ewing's book.

A Brief Elementary British Book on Sewerage Systems.

Reviewed by EMIL KUICHLING,* M. Am. Soc. C. E.

SEWERAGE SYSTEMS: THEIR DESIGN AND CONSTRUCTION.—A Practical Treatise upon the Principles of the Design, Construction and Maintenance of Town Sewerage Systems, with Examples of Existing Works. By Hugh S. Watson, Assoc. M. Inst. C. E.; Author of "Town Scavenging and Refuse Disposal," with Legal Notes on the Principal Acts of Parliament and the Legal Procedure relating to the Provision of Works of Sewerage, by Elidyr B. Herbert, Barrister-at-Law. New York: McGraw-Hill Book Co. London: Crosby Lockwood & Son. Cloth; 6½ × 9½ ins.; pp. 310; 150 diagrams and working drawings in text; eight tables. $4, net.

This book purports to be a practical treatise on modern sewerage systems, and the reader accordingly expects to find in it a summary of the latest recent practice in this branch of engineering, especially as the author refers in his introductory pages to the numerous articles on the subject that have appeared in the principal European and American technical publications. Unfortunately, however, this expectation is not realized, since the work is mainly of an elementary character. It gives much good general information about sewerage and some of the difficulties associated therewith, but it is lacking in the exposition of methods for computing scientifically the proper dimensions of structure and the attainment of desired results. While generalities are often useful in popular hygienic dissertations, yet the practising engineer has need of a multitude of technical details and data that do not interest the public, and it should be the aim of ambitious authors to supply them in clear and concise form. Much excellent material for a thoroughly useful treatise on sewerage is available in the publications mentioned, and it is to be regretted that so little thereof has found place in the book under consideration.

A few instances of inadequate treatment of important topics by the author are cited in the following. The intricate subject of rainfall and runoff from urban areas is discussed in only a few pages, and reference is made only to the Burkli-Ziegler formula and to another formula that was presented in 1906 by Mr. D. E. Lloyd-Davies in a paper before the Institution of Civil Engineers of Great Britain. This latter formula is described as being original with Mr. Lloyd-Davies, and the author states that "owing to its comparatively recent introduction, it is but little employed up to the present." On examination, this method of computing the runoff Q in cubic feet per minute from an urban district of A acres, is seen to be simply the product of the number of acres Ap of impervious surface in the district by

$$\text{the rate } \frac{r}{t} \text{ of precipitation in cubic feet per acre}$$

per minute; r being the depth of rainfall during the time of t minutes required for a particle of water to flow over the surface to the uppermost sewer inlet and thence through the longest line of sewers in the district. In reality this method was first devised by an American engineer and published in the Transactions of the American Society of Civil Engineers for 1889 (Vol. XX., pp. 1-56), since which time it has been extensively adopted both at home and abroad. It is therefore neither new nor untried, and the only trouble with its use is the determination of the maximum depth r of rainfall for which provision is to be made in the contemplated sewers.

The discussion of the least velocity of flow to render a sewer self-cleansing is much too brief. The author states that it was formerly considered necessary to make such velocity not less than 2.5 ft. per sec., but that within recent years a minimum velocity of 2.25 ft. per sec. in pipe sewers from 6 to 12 ins. in diameter, and of 2.0 ft. per sec. in larger conduits, has been deemed sufficient by the British Local Government Board. This statement may be entirely satisfactory to some engineers, but others would greatly prefer to see the data on which these figures are based. From several recent observations of this kind that have been published, the inference may be drawn that deposits will not occur in a sewer of more than 2.0 ft. diameter if the velocity of flow is only 1.5 ft. per sec. The character of the solid matter that is allowed to enter the sewer and the depth of flow are the principal factors in this question, and a collection of observations in a variety of well-built sewers of modern design will certainly be more valuable than the mere reference to the hackneyed laboratory experiments made by Dubuat more than a century ago. The same may also be said in relation to the cited maximum permissible velocity of 6 ft. per sec., which is very often exceeded in good practice.

The subjects of sewer ventilation and flushing are well presented in general terms, but no data are given that will facilitate a rational solution of these important problems. Many interesting experiments have been made and published within the past twenty-five years that should have found place in the book. With reference to the quantity of ground-water that finds its way into sewers, either directly from subsoil drainage pipes or indirectly through joints that have become defective in course of time, no figures are mentioned, although it often happens that a considerable proportion of the capacity of sewers laid through wet ground is taken up by this water. Similarly, with the important subjects of interception and inverted siphons, the author has been much too brief. Mechanical devices for definitely controlling the admission of storm water into an intercepting sewer are frequently required, and much ingenuity has been expended on their design; but no details of their construction and operations are given.

The use of an inverted siphon in the line of a large sewer has always been associated with the possibility of serious obstruction by deposits during periods of drought, and much care has been taken in some cities to prevent such obstruction by providing a deep catch basin for heavy detritus at the head, and cleaning it at frequent intervals. Quite recently the expedient of laying two or more pipes of different size has been adopted, the smaller pipe being adapted to the dry-weather flow and the larger one to the storm water. It would be very interesting to have an account of the operation and maintenance expenses of the different types of such construction, and the velocities necessary to avoid deposits therein.

In regard to rules for computing thickness of the walls of masonry conduits, little information is given. Dupuis' formula for the thickness of the arched roof of Parisian sewers is the only one submitted, but the author omits to state that the coefficients thereof are based on taking the dimensions in meters. To make the formula applicable to measures in feet, it is necessary to change the coefficients of the term containing $\sqrt{D}$, in which D is the diameter of the semi-circular roof. For proportioning reinforced-concrete conduits no directions whatever are given, so that the student is compelled to seek advice elsewhere. It is difficult to understand why such omissions should occur in a treatise intended for practical use by a busy engineer.

In other respects the book is well written and contains many interesting references. The chapter relating to the English laws governing the construction of municipal sewerage works is instructive, although of little use to American readers. In comparison with our recent American books on sewerage, Mr. Watson's treatise does not exhibit any marked superiority, and it is hoped that this will be remedied in its next edition by copious additions.

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City and Suburban Electric Trains.

Reviewed by GEORGE GIBBS.* M. Am. Inst. E. E.

ELECTRIC TRAINS.—By H. M. Hobart, M. Inst. C. E. New York: D. Van Nostrand Co. Cloth; 5½ × 9 ins.; pp. 201; 88 illustrations. Price, $2.50, net.

The book deals almost exclusively with electric trains for city and suburban service and purposely leaves out of consideration the subject of electric locomotives and long-distance running.

As stated in the preface, the book is the first one to carry the subject through from a sample speed-time curve to the energy consumed on the train, taking into account all the different items affecting it. A series of calculations leading to this result is given and should prove to be of interest and value to beginners in the subject of electric traction.

The book follows the English and European practice quite closely and, therefore, the weights of trains used are rather light as compared with weights of interurban trains in this country. While the greater portion of the book is to a considerable extent analytical, a description is given of certain English traction installations, including details of weights of electric train apparatus and cars. These statistics, while of interest to the student, can hardly be taken as a guide for American practice. It would appear, furthermore, that the information at the author's disposal, especially in regard to the newer systems of electric traction and practice elsewhere, has not been sufficient to enable him to draw altogether accurate comparisons in his "Summary and Conclusions."

Developments in the electric traction field, especially in connection with the newer systems, such as the single-phase, have been so rapid that it is not safe to base comparisons upon certain specific installations of several years ago. For example, the author's statement to the effect that the engineers of the Pennsylvania Railroad, after very thorough tests of a single-phase locomotive on a special piece of track, found the system inferior to the continuous current, is not correct. As a matter of fact the single-phase locomotive tested gave a very good account of itself, and the conditions which entered most largely into the decision to use direct current in connection with the Pennsylvania Railroad's tunnel extension into New York, were the use of the direct current system already established on the Long Island Railroad, the trains of which road were to use the new station; small clearances and other tunnel conditions; and the advisability of adopting a thoroughly developed system rather than experimenting with untried devices for numerous special conditions of the Terminal Railway, both physical and operating. In general, it is unwise to draw comparisons from generalities. In any case, the merits of the various systems of traction available should always be considered in connection with specific cases in order to arrive at correct conclusions.

Notwithstanding its limitations, the book should prove useful to students of the theory of electric train operation, and is an interesting and instructive résumé of the progress which has been made in England in the introduction of rather heavy electric traction.

A PRACTICAL GUIDE TO IRON AND STEEL WORKS ANALYSES.—Being Selections from "Laboratory Notes on Iron and Steel Analyses." By Walter Macfarlane, F. I. C., Principal of the Metallurgical Department, Staffordshire Education Committee. New York and London: Longmans, Green & Co. Cloth; 5 × 7½ ins.; pp. 184; nine illustrations in text. $1.25, net.

This "guide" is a handy-sized manual, a "handbook" some would say, for the guidance of a staff of iron-works chemists. The material is selected from the author's larger "Laboratory Notes on Iron and Steel Analysis," and it has about one-third the size of that book. This larger work was very favorably reviewed by Dr. Bradley Stoughton, in this Supplement, Jan. 13, 1910. To the extracts from the "Laboratory Notes" there has been added a short section on the proximate analysis of solid fuels.

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A New British Book on Water Purification

MODERN METHODS OF WATER PURIFICATION.—By John Don, F. I. C., A. M. I. Mech. E., and John Chisholm, A. M. I. Mech. E., Engineer and Manager of the Airdrie, Coatbridge, and District Waterworks. New York: Longmans, Green & Co. London: Edward Arnold. Cloth; 5½ × 9 ins.; pp. 368; 96 text figures (two folding plates); appendix (11 tables). $4.20, net.

Since no book on water purification, at least in the English language, has appeared for a number of years past, this comprehensive review of substantially the whole field is welcome. The book will be all the more welcome this side of the water because, unlike so many British authors, the writers of this volume have not restricted themselves to British ideas and practice. It is true that they do not adequately present the science and art of water purification as practiced to-day in the United States and in the leading European countries outside of Great Britain, but they do show that they have given considerable attention to foreign practice, particularly as exemplified in the principal literature of the world.

The task set themselves by the authors is expressed briefly in the first paragraph of their introductory chapter, as follows:

> Designed to render an account of modern developments in the theory and practice of water purification, this work is an attempt to bring under the notice of Water Authorities and their officials the most efficient appliances for the treatment of water, together with the details of working and costs of construction and management.

In the main the authors seem to have accomplished their purpose, but it is pertinent to note that they seem to have done better when dealing with principles and general practice than when taking up specific devices. For some reason proprietary devices and processes seem to cast a charm about the most competent and discriminating British writers, so that when they enter into descriptions of such devices, they almost invariably fall under the spell of trade catalog literature and puffs. When British authors keep comparatively free of this spell the best they generally do is to give more or less categorical descriptions of the various proprietary devices, without valuable critical comment. For the most part our present authors have not yielded to the enchanting claims of the manufacturers whose devices they describe, but, as a rule, they fail to give information as to the relative value of the different devices falling in the same class.

After a brief general introduction the authors take up in succession the relative qualities of the various sources of supply, the relation of storage to the quality of water, the construction of storage reservoirs, with particular reference to sedimentation and quality, and the care of water after it has once been purified. In this connection something is said regarding the treatment of water with ozone and also with hypochlorites—subjects which are taken up at more length later on. Then follow two chapters on sand filtration and the care of sand filters, and a separate chapter on mechanical filters. The treatment of sand washers for use with slow sand filters is so inadequate as to be almost absurd, in view of the great importance of sand washing and the progress which has been made in apparatus and in cost reduction within the past five or ten years.

Particularly interesting are the descriptions of the Puech-Chabal multiple system of filtration; the Howard four-stage pre-filtration system, which involves subsidence in chambers beneath upward-flow filters, the filters being, first, two of gravel and then two of polarite (as installed at Egham, England, by a proprietary company); and sand filters of a non-submerged type, the sand being fine and the water sprinkled on and the rate of filtration being slow. The authors say that "the Puech system has been imitated by American engineers for the supply of Bethlehem, U. S. A., except that the 'scrubbers' all lie in one bed." If we mistake not, this reference is to rough filters installed some years before the Puech system was ever heard of in this country.

Under mechanical filters the authors state that the makers do not intend the Jewell filter for connection directly with the water mains, which may perhaps be true in England. They speak of the Bell filter (of British make) as being identical with the Jewell in design, but in general they do not seem to be familiar with the history and details of mechanical filters as developed in the United States, nor to recognize that most, if not all, the mechanical filters abroad are mere copies, with or without changes, of American designs.

At the end of the chapter on mechanical filters, some three pages are given on disinfection by calcium hypochlorite. Too much stress seems to be laid upon the likelihood of tasting the chlorine where hypochlorites are used. This seems to be due in part to the influence of the claims made for the so-called De Chlor process for avoiding such taste. It may be, however, that it has not yet been learned in England how minute are the quantities of hypochlorite which suffice to disinfect water. Anyway, the authors give no idea of the remarkable growth of the use of hypochlorite for water treatment in the United States during the last three years, and therefore it may be presumed that they were not acquainted with the status of the art here.

The chapter on ozone is good, particularly in view of the fact that to it only 28 pages are given. It includes physical data not otherwise available in English, so far as we know. It fails, however, to give an adequate conception of what has been done with ozone in the United States, mentioning only one of three processes which are being developed here. From the language used on page 220, one might infer that the whole water-supply of Philadelphia is treated by ozone, whereas only a small private supply has ever been so treated. Moreover, the particular process or apparatus mentioned by the authors as being in use at Philadelphia was superseded some time ago by another. Such omissions and errors as these, however, are more or less unavoidable in dealing with developments in foreign countries and should be excused to a considerable extent—just as we must excuse the authors for locating certain experiments at Reading, Pa., instead of Reading, Mass. Perhaps one other criticism ought to be made of the chapter on ozone: the authors leave their readers to infer as best they may that, notwithstanding all that has been done with ozone in various parts of the world, it is still far from being a practical means of treating water on any considerable scale, at least where financial economies must be practiced. The reported failure of the ozone installation at Lindsay, Ont., does not seem to have come to the attention of the authors.

Next comes a chapter on "Water-Softening and Household Appliances." Various household filters are mentioned briefly. The bulk of the space is given to softening, and is occupied chiefly with descriptions of various proprietary devices in use in England. At the close of this chapter a few interesting paragraphs are given to the use of "Permutit," a trade name which has been applied to artificial zeolites manufactured in Germany for use in water softening. This material is a compound of silica alumina and sodium oxide. A form which makes use of manganese is used for the removal of iron and manganese in water.

Two chapters devoted to "The Testing of Water" include information on bacteriological, chemical, and microscopical analyses, including studies of plankton.

The two final chapters are entitled "The Problems of Distribution." These chapters are a curious mixture of matter wholly pertinent to the book and other matter which, so far as we can see, has absolutely no place within it. Included in the latter is information on the layout of distribution systems, types of hydrants, and, more surprising still, water-hammer, including a full-page section of a safety valve to prevent hammer. Other matter in these chapters which would hardly be expected in a book on water purification deals with the comparative merits of cast-iron and steel water pipes, with joints and mains, and "best form of water taps." More pertinent matter is that relating to plumbo-solvency and its prevention, Crenothrix, removal of iron from ground water and removal of iron rust from mains, and also public health in relation to water-supply, including remarks on typhoid fever and cholera. The information on the relation of water to health seems meager, particularly in view of the space given to subjects which seem to have absolutely no place in the book.

Skeleton specifications for both mechanical and slow sand filtration plants and also for [illegible] plants are given in different parts of the [illegible].

An appendix and a brief bibliography [illegible] the volume. The appendix gives a few [illegible] data, mostly in tabular form, for use in [illegible] ing water-purification works. One table gives comparative figures for capital and [illegible] costs of sand filtration, ozone treatment, [illegible] De Chlor process, and another table gives similar data, together with physical data [illegible] for filters of the Jewell, Bell, Candy and [illegible] and Platt types, and like figures for Puech [illegible] tiple filters. In a footnote to this table we find the following naive statement—at least we should characterize it in this country:

> The above statistics may be accepted as substantially accurate, as they have been supplied through the kindness of the proprietors of the filters quoted.

From the foregoing notice we think it will be apparent that Messrs. Don and Chisholm have produced a book which, while open to adverse criticism (mostly mild) on many points, is nevertheless a material addition to the literature of water purification and one which, although dealing primarily with British ideas and practice, is well worth adding to the library of American water engineers and sanitarians.

Health Primers.

PRINCIPLES OF PUBLIC HEALTH.—A Simple Text Book on Hygiene, Presenting the Principles Fundamental to the Conservation of Individual and Community Health. By Thos. D. Tuttle, B. S., M. D., Secretary and Executive Officer of the State Board of Health of Montana. Yonkers-on-Hudson, N. Y.: World Book Co. Cloth; 5½ × 7½ ins.; pp. 180; 50 cts., net; by mail, 60 cts.

PRIMER OF HYGIENE.—By John W. Ritchie, Professor of Biology, College of William and Mary, Virginia, and Joseph S. Caldwell, Professor of Biology, George Peabody College for Teachers, Tennessee. Yonkers-on-Hudson, N. Y.: World Book Co. Cloth; 5½ × 7½ ins.; pp. 184; 113 text figures. 40 cts., net; by mail, 48 cts.

These books present in clear and simple form most of the fundamental principles of health. The book by Dr. Tuttle, on public health, gives considerable space to personal hygiene and to some extent duplicates the other book. The larger portion of Dr. Tuttle's book, however, deals with public-health matters, presented for the most part from the personal standpoint. Aside from the care of the person, Dr. Tuttle's book takes up foods, including milk; disease germs and their dissemination; the nature and methods for the prevention of the spread of a number of communicable diseases.

Writing of dirt and disease (p. 77) he says, with too little qualification in the context, disease germs "grow very fast" in "damp, dark places."

Great stress is laid upon the necessity of sewage-purification, the author going so far as to say (p. 115) "no sewage, no matter how small the amount, should ever be permitted to go into a stream until all the disease germs it contains have been killed." Earlier (p. 88) he says: "Keep disease germs out of your drinking water. You cannot drown them out and you cannot strain them out * * *." These two statements are certainly over-strong, particularly in view of the fact that the book contains no hint that there is such a thing as water purification—a strange omission, in view of the scope of the book.

The Primer of Hygiene needs no special mention here, except to say that it seems to deserve commendation. One of its authors, Prof. Ritchie, contributed to the same general series the "Primer of Sanitation" noticed in our issue of Jan. 13, 1910,. Of that book we were obliged to say that the author put a blot on an otherwise remarkable good presentation of his subject by inserting in his very last paragraph some absurd remarks on sewage disposal.

It is a pity that the authors of this series do not take more pains to verify the truth of the statements which they make when they get outside of their own particular provinces. They take great pains to submit their manuscripts or proofs to a considerable number and variety of persons engaged in public-health and in educational work, but somehow come short of consulting anybody who is fully grounded in the principles of sanitary biology and engineering.

The Economics of Real Estate Improvement.

BUILDING FOR PROFIT.—Principles Governing the Economic Improvement of Real Estate. By Reginald Pelham Bolton, Author of "Elevator Service," "Negative Powers"; M. Am. Soc. C. E., M. Am. Soc. M. E. New York: The DeVinne Press. Cloth; 5 × 11 ins.; pp. 124; 15 plates, 15 text figures and 8 tables. $2, net.

The improvement of metropolitan real estate for rental is a low-return investment. To the small investor who can readily realize 4% on his capital or to his more prosperous brother who can realize 6% on small real estate holdings with a minimum of risk, the net incomes of 3% to 5% gained by the million dollar structures in lower Manhattan, for instance, seem absurdly small. Doubtless these low returns are often based on an inflated land valuation, but nevertheless the assured stability of this form of investment, when properly designed and cared for, makes acceptable an income which would not be tolerated in investments of greater risk. The very fact that the returns are so small makes it imperative that the strictest economy be practised in construction and operation, and that the principles controlling these factors be fully understood by one about to invest large sums in such an enterprise.

The book before us undertakes to help the investor to this understanding. Its author, evidently, has had most of his experience in New York City and has drawn largely upon that locality for his examples. His experience, and as a result his book, are only applicable to localities in our other cities where similar property and economic conditions exist. In fact, it is only perhaps in a half-dozen cities in this country where a prospective builder has to go through the elaborate analyses proposed by the author before determining upon the nature of the building he is about to erect.

The first chapter is devoted mainly to the development and application of a formula giving the required rental per square foot of rentable area to produce a given interest on the investment, with the size of building, proportion of rented area, ratio of net to gross interest, etc., variable. Basically, this formula is ridiculously simple but a first reading of it would not lead one to that conclusion, so great an air of mathematical dignity accompanies it. There are so many variables in this solution that it seems that a formula is quite unnecessary, for it would be quite as simple to work out each case separately as it comes up. Chapter II. is devoted to an explanation of the principles underlying land-value appreciation. The author here combats the theory that depreciation of the building proper may be balanced by the appreciation of the land and maintains that to make the investment stable a sinking fund should be provided in all large building operations. This he essays to prove by several not quite lucid diagrams. He sets down the rational principle that there is a period of years, more or less ascertainable, beyond which it is not profitable to anticipate a building's usefulness, and to lay out an excess original cost to lengthen that period is uneconomical. In this same chapter he states the rule for the size of a building, as follows:

> The ruling consideration should not be the maximum expenditure which can be placed upon a site and earn interest on its own cost of construction, but with how small an investment in cost of construction the capitalized value of the land can be maintained.

This, too, is accompanied by several explanatory diagrams and examples. Chapter III. is an exposition, drawn from buildings already in use, of the relation of gross to net income in various classes of structures, namely office buildings, apartments and loft buildings. This relation is, of course, based principally on the cost of operation, which is taken up, however, more specifically in the final chapter.

The next two chapters take up the depreciation of buildings, both economic and physical. As stated above, the former of these two is perhaps more important than the latter, and is certainly much harder to determine. The author attempts an analysis of the causes and results of economic depreciation which, while interesting, hardly arrives at anything further than that it is a matter of judgment. In his analysis of physical depreciation he tabulates the accepted term of life of the various portions of a building and from this tabulation works out the probable expected age of any kind of a structure. This has some value in establishing the amount of sinking fund necessary, but the fact that he records such precise amounts as "steel, brick, terra cotta, 66 to 75 years" and "reinforced-concrete, 75 to 90 years," takes something away from the reliability of the figures. The chapter on the depreciation of operating machinery is more authentic because it concerns short-lived structures, whose ages are fairly well established.

In his statement of principles the author is sound, but the book suffers from a too elaborate explanation of simple facts and a ponderous treatment of the most apparent mathematical processes.

The Battle of Gettysburg.

GETTYSBURG.—The Pivotal Battle of the Civil War. By Captain R. K. Beecham, of the First Brigade, First Division, First Corps, Army of the Potomac. Chicago, Ill.: A. C. McClurg & Co. Paper; 5½ × 8¼ ins.; pp. 208; 67 illustrations in text. $1.75, net.

It is a fair generalization that history cannot be written by those engaged in the making of it. The perspective is lacking, the prejudices of partisanship overbalances judgment, and the nearness of personal experience prevents a broad grasp of causes and events. It is none the less true that the final historian who is to present the true story of a past era must have the personal narratives of participants in that era as well as the dry facts of official record, if he is to gain that all-embracing view that his work demands. The period of the Civil War is fast dropping into the historical past. Barely a decade remains in which we may expect the story of its battles and campaigns from the pens of those who fought in them, and therefore we should welcome any addition to its literature of personal narrative, as one more contribution to the material from which some future Creasy will work out the master history.

The book before us both suffers and benefits from the fact that its author played a part in the great battle he describes. Capt. Beecham was a member of the Second Wisconsin Infantry, a part of that "Iron Brigade" that went through the three days fighting at Gettysburg with a loss of 64% of its numbers, a loss unsurpassed by any other brigade on either side. Insofar as was possible to an officer of lower rank he has an intimate knowledge of the events of those three bloody July days, and although the horror of grim war is surprisingly absent from the pages, the story of the battle is quite evidently the story of one who saw and fought in it. On the other hand, this very association, though guaranteeing the Captain's authority, prejudices his judgment and colors his interpretation of the official records or contemporary accounts which he has had to consult. There is no getting away from the fact that it is the story of Gettysburg by a Union volunteer—with all the volunteer's right and desire to criticize his superior officers.

To the layman, for whom the book is undoubtedly primarily intended, a few maps would be welcome. Map-making being somewhat more in our province than the strategy of war, we feel free to suggest to future popular writers on past battles that they include a series of maps showing the position of the troops and the general trend of the fighting at intervals during the battles which they are at such pains to present verbally to their readers. The mechanical details of such maps need not be great because each could be reduced to the lowest terms, leaving the main topographical features to be shown on a general key map which could be reproduced in as fine detail as desired. The following of the movements of 200,000 troops over three days and 15 square miles, as at Gettysburg, is at best an involved process to the lay mind. How much more simple would it be if good maps, one for each three or four hours of the battle, helped out the text. The birdseye view of the field at Gettysburg that Capt. Beecham presents as a frontispiece would be admirable were it accompanied by the smaller maps that we suggest.

Completion of a Valuable Pioneer Work on Municipal Franchises.

MUNICIPAL FRANCHISES.—A Description of the Terms and Conditions upon which Private Corporations enjoy Special Privileges in the Streets of American Cities. By Delos F. Wilcox, Ph. D., Chief of the Bureau of Franchises of the Public Service Commission for the First District of New York, and Author of "The American City," etc. In two volumes. Vol. II.: Transportation Franchises; Taxation and Control of Public Utilities. New York: The Engineering News Publishing Co. Cloth; 5¾ × 8 ins.; pp. 885. $5, net.

Two thick volumes including altogether some 1,600 pages were found by Mr. Wilcox to afford none too much space for him to summarize the wealth of documentary material and to present the ideas resulting from his long study of municipal franchises. Taking into consideration the fact that, as we stated in our review of the author's first volume (May 12, 1910), this is the first attempt made by any one to survey the very important franchise field, and considering the range and character of the material presented, the author appears to be fully justified in permitting his work to run to such great length as it does. Many will doubtless feel that while much would have been lost no little would have been gained had the author compressed the results of his studies, or rather his digest of franchises, into smaller space. But there are doubtless as many and perhaps more who would prefer to see the digest extended rather than abridged.

About a fifth of the first volume deals with fundamental principles. The remainder was devoted to abstracts, with criticisms, of a large number of actual franchises, ranging over the whole municipal franchise field, with the exception of transportation and railroad franchises, which were reserved for Volume II.

The volume before us opens with a chapter entitled "The Surface Street Railway as a Factor in Modern Life." This is followed by 64 pages on the "Elements of a Model Street Railway Franchise." Fortunately for the reader, the author does not throw these "elements" into the form of an actual franchise, but instead discusses the various portions of his subject in a thoroughly interesting and suggestive manner, at the same time leaving few or no essential "elements" untouched.

Having outlined a model street railway franchise, the author devotes the remaining 500 of the 600 pages devoted to street and interurban railway franchises to a digest of actual franchises. He first gives a historical and critical review of street railway franchises in Greater New York and then takes up the very important street railway settlement franchises of Chicago and Cleveland. Subsequently, franchises of a large number of cities are grouped under some leading feature, such as perpetual or indeterminate in length; exclusive in character; granted for compensation or, in contrast, to secure low fares. A miscellaneous collection of franchises is then presented in digest, after which franchises for elevated railways, for passenger subway and freight tunnels and for interurban railways are abstracted and commented on.

Next come digests of bridge, viaduct and toll-road franchises; franchises for railroad terminals, spur tracks, docks and markets; and finally a chapter each on ferry franchises and on omnibus and coach franchises. These groups of franchises occupy substantially another 100 pages of the volume and complete Part III. of the whole work. (Part I., on fundamental principles, and Part II., on pipe and wire franchises, formed Vol. I.) This may be a good place to mention the fact that in an appendix to Volume II. the author gives in full the two Minneapolis Gas Settlement Ordinances, which would naturally have found a place in Volume I. had the settlements been effected early enough for that purpose.

The concluding portion of the whole work, Part IV., has the general title "Taxation and Control of Public Utilities." Here the author gets away from documentary abstracts and enters into a general discussion of such important topics as constitutional and statutory limitations in their relation to franchise grants; the initia-

tive and the referendum in relation to franchise matters; state supervision; local franchise bureaus and allied methods of city control, including boards of public utilities of Los Angeles, Cal., St. Joseph, Mo., the city commissions at St. Louis and Kansas City, Mo., the department of public utilities headed by a superintendent at Seattle, Wash., and the bureau of franchises, New York City. Here, also, the author discusses the employment of franchise experts and utility engineers. The next three chapters take up in succession the relation of public utilities to land values; compensation for franchises and taxation of the property of franchise companies; capitalization, capital value, appraisals and purchase price. Each and all of these subjects is gone into quite thoroughly, but yet not so exhaustively but what the reader can sympathize with the author in feeling that after all his 1,600 pages were insufficient for a thorough exposition of his subject in all its ramifications.

The final chapter, of only a few pages, presents some general considerations on municipal ownership. Although the author is very brief here, he makes it plain that he believes thoroughly in municipal ownership as the best way of avoiding the numerous franchise complications, with their attendant evils in many instances, which it has required so many pages to set forth; at the same time, he makes it equally evident that he believes that for the present municipal ownership, as a rule, is inexpedient. We quote the concluding paragraphs of this chapter as showing in brief both the attitude of the author on municipal ownership and also in regard to general methods of the control and regulation of franchise companies:

STEPS PREPARATORY TO MUNICIPAL OWNERSHIP AND OPERATION.—While the argument of this chapter has thus far been favorable to municipal ownership and operation, the author has neither space nor inclination to treat the subject exhaustively in this place. It has been his aim to prove, if possible, that those who have the case all settled against municipal ownership are radically wrong. The question should at least be kept open for future determination. A franchise that ties the city up permanently to private ownership and operation is a relic of the dark ages in municipal politics. All good citizens will rejoice at the arrival of the day when no one can object to municipal ownership on the ground that the city government is unfit to undertake it. Now that the ancient motto, "In time of peace, prepare for war," is being interpreted as tending to bring about the thing for which we prepare, I would suggest the following as a substitute, "In the era of franchises, prepare for municipal ownership." There are a number of steps that can profitably be taken now without waiting for the final decision as to the general policy of ownership. I suggest the following:

First, clear away all legal and constitutional obstacles to municipal ownership and operation, so that each city will have a free hand in dealing with the matter.

Second, tax and regulate the life out of perpetual franchises until the companies are willing to give them up for indeterminate grants, with a reservation to the city of the option to purchase.

Third, in every new franchise and in franchise readjustments, make provision for the amortization of existing capital value, so that when the city gets ready to take over the property it will not be prevented by the necessity of assuming a burden of debt that is impossible.

Fourth, establish public utility commissions or departments, franchise and accounting bureaus, and other agencies through which the cities will be acquiring knowledge and training men against the day when public utilities may be acquired for municipal operation.

Fifth, remove the curse from municipal government as rapidly as possible by establishing effective responsibility and cultivating efficiency and constructive civic statesmanship.

Sixth, take a wide look around and a long look ahead, link up the problem of municipal franchises with the national conservation movement and kindle a fire under every sleepy citizen till even the street gamins, the club women and the great merchants on Broadway know what a franchise signifies.

Throughout the whole two volumes the author shows a keen appreciation of the evils which have arisen through the failure of American cities to safeguard the rights and interests of their citizens in both the granting of municipal franchises and in the regulation and control of franchise companies. The long series of struggles between cities and public-service franchise companies and the almost equally long series of failures from the city viewpoint makes indeed a dismal commentary on American municipal government. No wonder the author's final conclusion, in his brief chapter on municipal ownership, is that we are not yet ripe for the adoption of that policy. No wonder either, after his lengthy review of franchise complications and evils, that the author should feel it highly desirable for American municipalities to try to cut loose from these complications and evils just as soon as they have made noteworthy progress in municipal reform—as there is some reason from present indications to hope will soon be the case. No wonder, again, that the author is strongly of the opinion that the worst failures in municipal ownership which might be expected could scarcely prove so heavy a charge upon the people of our cities as has been caused by the unscrupulous financial practices of street railway manipulators in a large proportion of the cities of the United States.

An Unusual Report.

GEOLOGY OF THE NEW YORK CITY (CATSKILL) AQUEDUCT.—Studies in Applied Geology Covering Problems Encountered in Explorations Along the Line of the Aqueduct from the Catskill Mountains to New York City. By Charles P. Berkey. Bulletin No. 146, New York State Museum; John M. Clarke, Director. Albany, N. Y.: University of the State of New York, Education Department. Paper; 5¾ × 9 ins.; pp. 283; 32 plates (some folding) and 39 text figures. $2 per year to advance subscribers, or $1 per year for Division 1 and 50 cts. per year ea. for Divisions 2, 3 and 4.

It is rarely that a geologist has presented to him so comprehensive and withal so practical a problem as that which the geologists on the Catskill Aqueduct of the New York City water-supply had to face. The transportation of 500,000,000 gals. of water daily from a distance of 90 miles and a height of some 300 ft. above the city, across (or under) numerous valleys and creeks and finally under the great Hudson River, with its deep pre-glacial gorge, naturally requires many and various structures whose stability depends as much upon the nature of the ground upon which they rest or through which they pass as it does upon the details of design or construction. In determining the nature of that ground, it is very probable that a greater amount of detailed investigation and study was placed than upon any similar geological survey ever attempted. Throughout the work the engineers assisted the geologists to a very great extent, particularly in the actual manipulation of drills, drawing of maps, etc., but the brunt of the labor was born by the geologists themselves, under the very able direction of Profs. Kemp, Berkey and Crosby.

Prof. Berkey has made of this book somewhat more than a mere geological report. As he says, "Seldom has so favorable an opportunity been afforded to follow extensive exploratory work and check geologic hypothesis or theory by subsequent proof." The deep excavations for dam foundations, the cuts through hills for surface conduits and the tunnel borings for pressure conduits and siphons all opened up the strata and rock which had been under investigation by borings and drill holes and confirmed or contradicted the preliminary studies in many cases. On account of this, there is somewhat more authority to many of the deductions of the geologists than is the case when the sub-surface is never exposed to view. The author has utilized this exceptional condition to make his report partially an educational treatise, a textbook not only on the geology of a very important, though restricted, section of this country, but also upon the methods to be pursued in geological surveys where the direct end in view is the establishing of data for immediate use in the design of engineering structures.

A final chapter, entitled "The General Question of Post-Glacial Faulting," has a special bearing on the occasionally raised possibility of an earthquake in Manhattan Island. Prof. Berkey arrives at the following rather indefinite conclusions:

Somewhere within post-glacial time, i. e., approximately 25,000 years, movements of strata have developed at a few places in eastern New York that appear as small faults with total throw in each locality varying from a few inches to perhaps as much as 2 ft. Whether [illegible] ment has been gradual and continuous or [illegible] largely into some small portion of this time is [illegible] Whether the effects are extensive or, on the [illegible] very local and superficial, is likewise unknown [illegible] any case there are no known instances of [illegible] large displacements, such as would be likely [illegible] great damage to sound structures, in this region [illegible] glacial time.

Philosophy of the Taylor System, by [illegible] Originator.

THE PRINCIPLES OF SCIENTIFIC MANAGEMENT. By Frederick Winslow Taylor, M. E., Sc. D., President Am. Soc. M. E. New York and London: Harper & Bros. Cloth; 5¾ × 9 ins.; pp. 144. $1 net.

Those who have been looking for an authoritative exposition of what has come to be known as "scientific management" must doubtless have turned to Taylor's "Principles" as the object of their search. They will not find the exposition of a system, for Mr. Taylor does not call it a science, but a philosophy. We quote:*

Scientific management fundamentally consists of certain philosophy [p. 28, p. 130].

The origin of any new system of thinking, and the motives back of it, are always of peculiar interest. Mr. Taylor sets forth that he was moved to evolve this philosophy by the desire to stop the "soldiering" in which workmen indulge.

Underworking, that is, deliberately working slowly so as to avoid doing a full day's work, is almost universal in industrial establishments, and constitutes the greatest evil with which the working-people of both England and America are now afflicted [p. 13].

A large proportion of the workmen of both countries each day deliberately work slowly so as to curtail the output [p. 17]. In 19 out of 20 industrial establishments the workmen deliberately work as slowly as they dare while they at the same time try to make those over them believe that they are working fast [p. 33].

Under this plan [pay by the day] the better men gradually but surely slow down their gait to that of the poorest and least efficient [p. 19]. It is, however, under piecework that the art of systematic soldiering is thoroughly developed; after a workman has had the price per piece of the work he is doing lowered two or three times as a result of his having worked harder and increased his output, he is likely entirely to lose sight of his employer's side of the case and become imbued with a grim determination to have no more cuts if soldiering can prevent it [p. 23].

The writer came into the machine-shop of the Midvale Steel Co. in 1878. As was usual then and in fact as is still usual in most of the shops in this country, the shop was really run by the workmen and not by the bosses. The workmen together had set a pace for each machine, which was limited to about one-third of a good day's work. As soon as the writer was made gang-boss [he] told them plainly that he proposed to do whatever he could to get a fair day's work out of the lathes. This immediately started a war. The writer used every expedient to make them do a fair day's work. Soon after being made foreman he decided to make a determined effort to in some way change the system of management, so that the interests of the workmen and the management should become the same, instead of antagonistic [pp. 48-53].

The philosophy which Mr. Taylor presents as a result hereof is expressed in certain principles. They are principles or rules for the managers, and express the enlarged duties of the management. Again adapting Mr. Taylor's words slightly, they are:

(1) Develop a science for each element of a man's work, to replace the old rule-of-thumb method.
(2) Scientifically select and then train, teach and develop the workman, whereas in the past he chose his own work and trained himself as best he could.
(3) Heartily cooperate with the men so as to insure all of the work being done in accordance with the principles of the science which has been developed.
(4) Divide the work and the responsibility between the management and the workmen. The management take over all work for which they are better fitted than the workmen, while in the past almost all of the work and the greater part of the responsibility were thrown upon the men [pp. 36-37, p. 83].

These principles are more vital than the particular way of applying them, it appears, for Mr. Taylor says:

Unfortunately most readers have mistaken the mechanism for the true essence. A description of what any one man or men may believe to be the best mechanism for applying these general principles should in no way be confused with the principles themselves [pp. 28, 29, p. 128].

Still, the mechanism is better to give a con[illegible]

*All the quotations in the review are condensed or adapted, with omission of intermediate phrases, sentences or whole paragraphs. Every effort was made to retain the sense of the original strictly.

ception of the Taylor system than are principles. And we therefore welcome ent of the particular mechanism used r and his followers:

ents of this mechanism may be cited:

e study; (2) Functional or divided foremanship; ardization of all tools and implements, and also cts or movements of workmen for each class (4) A planning department; (5) The "exception " in management; (6) The use of slide-rules and time-saving implements [slide-rules for fixing cut, feed and speed of cutting-machines]; (7) ion cards for the workman; (8) The task idea in ment, accompanied by a large bonus for the successful performance of the task; (9) The differential payment; (10) Mnemonic systems for classifying manufactured products as well as implements; (11) A routing system; (12) A modern cost-system, etc. [pp. 129-130].

attentive reader may note (after eliminating the last three items as secondary) that the elements of mechanism are all of them parts of the task-and-bonus system; i. e., element (8) includes the others. For, time-study and standardization are preliminaries to task-setting; the planning department and the instruction cards are the means of setting the task; slide-rules translate a part of the task into other language; and functional foremanship supervises the task-working. Again the task is accepted by the workman under the incentive of the bonus, modified by a differential rate to protect quality of output. Thus, the Taylor philosophy is materialized into the task-and-bonus system. Our conclusion receives some direct support in the author's words:

The task and bonus constitute two of the most important elements of the mechanism of scientific management. They are especially important from the fact that they are, as it were, a climax, demanding before they can be used almost all of the other elements of the mechanism [p. 122].

The text of the book is occupied largely with illustrative cases: the famous pig-iron loading case, whose main character is "a man of the mentally sluggish type" called Schmidt for the sake of argument; experiments at Midvale; ore-shoveling at Midvale; Gilbreth's innovations in bricklaying; ball inspection in a factory of steel balls; a machine-shop making a staple machine; an establishment employing 3,000 to 4,000 men (a case of failure through inexperienced application).

Two vital features of the subject are: (1) To what extent does Taylor management involve selection of specially fit workers and elimination of the less efficient; and (2) How permanent is the worker's increase of pay. No light is thrown on the second point, which is unfortunate because other advocates of "scientific management" have claimed that the system automatically ensures the permanence of the increase rates of pay.

As to the degree of selection of workers which is likely to occur, only one of the cases cited gives actual figures. This was the Schmidt case, where

in this gang of 75 pig-iron handlers only about one man in eight was physically capable of handling 47½ tons a day [the task set as standard].

In several of the other cases it is indicated that there was much discarding of the less efficient workers, but we find no definite figures.

The book is a slightly modified copy of one which was circulated by the author privately among the members of the American Society of Mechanical Engineers. In both forms the book makes clear that Mr. Taylor has determined by experiment many facts and figures bearing on improved methods in individual operations or trades, as for instance the best sizes of shovels, the best ratio of working and resting periods in several different kinds of labor, the best tools and working rates for metal-cutting in lathes, etc. Of these the latter subject was fully dealt with in his Presidential Address to the American Society of Mechanical Engineers a few years ago, "The Art of Cutting Metals." The facts for the other subjects are still unpublished.

Such facts, however, are fundamental to "scientific management"; i. e., the first step in scientific management of, let us say, pattern-making is to learn how to make patterns most quickly and most cheaply. It is then tacitly assumed that the way found best for Patternmaking Manager Brown is also the best possible way for Patternmaker Jones.

The book deserves and will doubtless receive wide and critical study. The economic utilization of labor in production is a very important matter. No one can doubt that Mr. Taylor has rendered an important public service by the work he has done in applying engineering principles and methods to this problem. That this is only one aspect of the labor problem, and that measures for the general welfare of workers ought also to be undertaken—that the man as an individual must be thought of and cared for as well as the man as a part of an industrial machine—is recognized by the ablest advocates of the Taylor system.

More Books on Flying.

BIRDFLIGHT AS THE BASIS OF AVIATION.—A Contribution Towards a System of Aviation. Compiled from the results of numerous experiments made by O. and G. Lilienthal. By Otto Lilienthal, with a Biographical Introduction and Addendum by Gustav Lilienthal, Architect and Teacher at the Humboldt Academy. Translated from the second edition by A. W. Isenthal, A. M. I. E. E., F. R. P. S. New York and London: Longmans, Green & Co. Cloth; 6½ × 9½ ins.; pp. XXIV. + 142; one portrait, eight folding plates and 94 text illustrations. $2.50, net.

PRINCIPLES AND DESIGN OF AEROPLANES.—By Herbert Chatley, B. Sc., A. M. I. C. E. I.; (Engineering) Mem. Aero. Soc. of Great Britain; Mem. Soc. Arts; Professor of Civil Engineering, Imperial Railway College, North China. New York: D. Van Nostrand Co. Boards; 3¾ × 6 ins.; pp. 109; seven illustrations in text. 50 cts., net.

VEHICLES OF THE AIR.—A Popular Exposition of Modern Aeronautics with Working Drawings. By Victor Lougheed, Mem. of the Aeronautic Soc., Founder Mem. of the Soc. of Automobile Engrs., etc. Second edition, revised and enlarged. Chicago, Ill.: The Reilly & Britton Co. Cloth; 6¾ × 9¾ ins.; pp. 514; 270 text illustrations. $2.50, net.

All those who are interested in dynamic flight, no matter how closely or from what viewpoint, will welcome the tardy translation of Otto Lilienthal's memoirs. He it was, indeed, who took aerial flight from speculative physics and by essentially engineering studies, made it a practical reality. He did not live to see independent power flight but he attained considerable success with gliders and, after his own lamentable death, his work was carried forward with little interruption by Chanute and the Wrights, among others.

This book is a translation of Otto Lilienthal's own account of his work with his brother Gustav. The latter contributes an interesting personal foreword telling how they came to be pioneers in this field, how they strove under great difficulties to prosecute their studies, and showing finally how Otto's engineering practice after a time yielded him the necessary support so that effective efforts could be made.

Otto Lilienthal's accounts of his experiments and their places in his development of a logical design of dynamic flyer, of course cover ground which is now quite familiar. His errors have been corrected by later investigators but they have been comparatively minor and only what were to be expected of such pioneer excursions into a strange field. He constantly worked to develop a flyer that would probably have more closely approached bird form than the propeller-equipped types which his successors have brought out. He believed that the economy of the propeller was too low to permit of that easy flight which our feathered neighbors have. He evidently foresaw the need of excessive speeds for such types as now ply the air, and he believed that flapping flight brought into play phenomena which are still unstudied and which increased the economy of effort. Perhaps but for his untimely death we should have been nearer success on this line.

These memoirs, though filled with abstract discussions of theory and experiment, have been given a strong human interest and the reader almost begins to feel in himself the Lilienthals' hopes and experiences. The translator has done well to preserve such an atmosphere in these pages, now mostly of historical importance.

Mr. Chatley, in this little handbook, has stated the essential elements of the problem of dynamic flight, so that the casual reader, having some mathematical and scientific education, may understand the action of present successful flyers. First he outlines the effect of relative motion between a flat surface and the air and shows how the lifting component of the resistance force is calculated and utilized. Then the amount of power required to overcome the resistance to relative motion is discussed and motors and propellers are taken up. At different points the necessities and difficulties of balancing the many and complicated force reactions are pointed out. Calculations are shown, for the design of the framework of a flyer, to secure sufficient strength of the several members to insure safety. Finally the author indulges in a few remarks on the probability of advance in future designs. He believes that the limitations of artificial flapping flight are too great and depend too much on artificially unattainable characteristics of natural wings.

The author of "Vehicles of the Air" seems to have tried to make this "popular exposition of modern aeronautics" a veritable encyclopedia of related subjects. The result has been a massive volume containing much that we should expect the deeply interested reader would have available already in more complete treatises on these related matters and which the casual reader does not need. Among such topics may be mentioned materials of construction, details of internal-combustion engines, electric power, transmission gears, ball and roller bearings, lubrication and lubricants. The book is encumbered also by reprinting some twenty-five pages of a semi-mathematical dissertation on gliders by Prof. J. J. Montgomery, of California. Here an attempt is made to apply the laws of momentum and impact of elastic bodies to the problem of fixing the most favorable character of supporting surfaces and to the explanation of soaring flight of birds. Either Prof. Montgomery had not a perfectly clear conception of his own efforts, or the author of this book has made injudicious selections from the original papers, since the discussions are labored and disconnected and the general deductions are un-illuminating. The author elsewhere shows a marked admiration for this Prof. Montgomery and a touch of impatient temper toward those inventors who have attained greater commercial success by what he considers evidently an infringement of patent rights. The author is so impressed with Prof. Montgomery's work, as disclosed in the reprinted discussions of this book, that he exclaims:

The time is certain to come when the clear logic and brilliancy of these remarkable investigations and conclusions. . . will rank their author not only with present day aviators but with the world's greatest physicists and mathematicians.

The book is arranged in 15 chapters, not including a 40-page introduction, largely prophecy about moral aspects, dangers, applications, etc., etc. The first chapter has the usual and expected matter on the phenomena of the atmosphere and the physicial properties of air. There is a second chapter outlining the history of the balloon and giving a general idea of this branch of aeronautical practice.

Three-quarters of the text (13 chapters) are devoted to dynamic flight and flyers. The first part (Chapter 3) is largely historical and follows the now well-mapped march of events—except in the amount of attention given to the work of Prof. J. J. Montgomery. Brief sketches are given of those men who, in the author's opinion, have contributed to the advance of the art of flying by particularly original or successful work. The list is limited to Ader, Bleriot, Chanute, Langley, the Lilienthals, Penaud, Pitcher, Santos-Dumont, Wenham, the Wrights, the Voisins, and of course Prof. Montgomery.

Chapter 4 is a long one and starts off by comparing birds, insects and even "flying fishes," "flying frogs," and the prehistoric "pterodactyl" to modern dynamic flyers. Here are short discussions of flat and curved "planes," resistances, pressures, balancing methods, movable wing tips, rudders and control mechanisms. Chapter 5, on "Propulsion," describes the general features of design and construction of propellers.

Chapters 7 to 9, inclusive, treat of what we may call the mechanical engineering side—engines, power transmission, bearings and lubrication. The descriptions are comprehensive—indeed, including more than most readers of the "popular" class would assimilate safely. This extraneous matter for instance on gas-engine ignition by hot tubes, compression, catalytic action, on fuel pumps for kerosene stationary engines, on electric power on the development and design of ball bearings, etc., serves only to distort from true perspective the view which the casual reader shrould receive of the various parts of a flying machine and their inter-relation.

There is a chapter on "Starting and Alighting," in which considerable space is given to the Wrights' weight-actuated device which has now been discarded, in part at least, in the course of developing their biplane flyer. In Chapter 12, on "Typical Aeroplanes," we might expect to see some note of the later Wright machines equipped with starting wheels and without forward guide planes but we look in vain. The author contents himself here by including the Antoinette, Bleriot, Chanute (glider), Cody, Curtis, Farman, Langley, Lilienthal (glider), Maxim, Montgomery, Pilcher (glider), R. E. P., Santos-Dumont, Voisin and Wright machines. To show conclusively how much the development of the aeroplane is due to the author's friend, Prof. Montgomery, the patent specifications and claims of the Wrights, Montgomery, Chanute, Mouillard and Lilienthal are reprinted.

A chapter on "Accessories" contains a few good words on aerial-speedometers (anemometers) height recorders (barometers), compasses, vanes and levels. It also contains several pages of unnecessary descriptions of arc and incandescent electric lamps, acetylene lamps, tanks and generators, oil lamps, reflectors, etc., etc., which may, or may not, become important adjuncts of aerial travel. A final chapter gives the various aeroplane records which had been made, up to June 15, 1910.

One great, attractive feature of this book is the illustrations—the brown half-tone reproductions of photographs by several French photographers. Here are some 250 views of all the leading machines, showing details of design, stages of construction and various typical flights. The text is well written, the style is simple, clear and easy.

HYDROGRAPHIC MANUAL.—For the Guidance of Engineers, Hydrographers, and Other Employees Engaged in Hydrographic Work. Compiled by G. K. Larrison, Assistant Irrigation Engineer. (Department of Commerce and Police, Bureau of Public Works, Irrigation Division.) Manila, P. I.: Pub. Doc. (Bureau of Printing). Leather; 5 × 7¾ ins.; pp. 72; 18 illustrations in text.

This manual has been prepared for the use of the engineers engaged in hydrographic work for the irrigation division of the Philippine Bureau of Public Works. It is largely made up from similar publications of the U. S. Geological Survey, with corrections and additions needed in the local field.

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE.—Report of the Surgeon General (Walter Wyman), 1910. Washington, D. C.: Pub. Doc. Cloth; 5¾ × 9¼ ins.; pp. 256; Appendix.

The Service is doing an increasing amount of work relating to municipal health problems. In the report before us summaries are given of investigations of typhoid fever outbreaks in Omaha, Neb., and Williamson, W. Va., and mention is made of the continuance of studies of typhoid fever at Washington, D. C. A further and final report summarizing, we presume, the four years or more of the Washington studies is promised. A separate bulletin has been issued on the Omaha investigations. Brief mentions are made of experiments with privies and night soil, and comments are made on the use of night soil as a fertilizer. According to the report, the indications are that, under conditions prevailing in the South at least, the use of night soil as fertilizing material is dangerous. Besides the information just noted, numerous other topics are taken up in the report under the general head of "Scientific Research and Sanitation." In addition, there is the usual yearly review of the quarantine and other work carried on for years by the Marine-Hospital Service before its title and scope were enlarged.

An Important Addition to Public-Ownership Literature.

PUBLIC OWNERSHIP OF TELEPHONES ON THE CONTINENT OF EUROPE'—By A. N. Holcombe, Ph. D., Instructor in Government in Harvard University. Boston and New York: Houghton Mifflin Co. Cloth; 6 × 9 ins.; pp. 482. $2, net; postage, 17 cts.

Public ownership of telephones in Europe has followed naturally, though sometimes laggardly, the government ownership of telegraphs. The telegraph has been kept in strictly public monopoly from the outset in most, if not all, European countries, largely through the military reasons which explain so many conditions common to Europe but not found in the United States. The book before us covers Western Europe. Every country reviewed, except Germany and Switzerland, started with private ownership of the telephone, but, generally speaking, kept a close grasp upon the right to take over the service at any time. This right was speedily exercised in most of the countries, Italy alone of those finally exercising it letting the matter drag on until after legislation to that end was approved in July, 1907. Public ownership now exists in all the countries reviewed in this book, with the exception of Denmark and Spain, and divided ownership in Norway, Sweden and Holland.

Before giving further attention to the contents of the volume it may be explained that the work was originally undertaken as a Harvard doctorate thesis, but "has been completed with the aid and encouragement of university teachers in five countries." The volume certainly gives evidence of exhaustive and painstaking investigation. Much of this appears to have been made in the countries themselves. For the most important of the countries treated, namely, Germany, France and Switzerland, the author went through original documents, an abundance of which are cited in the footnotes.

In view of the relation of the European telephone systems to the telegraph, the book opens with a chapter entitled "The Origin of the European State Telegraphs." It is interesting to note that this goes back to the optical telegraph, developed in 1793 by a Frenchman and used extensively for military purposes from that time until the introduction of the electric telegraph.

Coming to his main subject, the author first devotes about two hundred pages to a detailed account of the introduction of the telephone into Germany by the Imperial and various minor State Governments and the subsequent development of the industry and its relations to labor problems and to the other German electric public-service undertakings. Several chapters are given to German telephone rate questions. These are introduced by a general discussion of the theory of reasonable rates.

Following the section on Germany, Switzerland is taken up in accordance with the same general plan, but the relative simplicity of the subject requires only some fifty pages. France is given about one hundred pages. Approximately fifty pages suffice for Belgium, Holland, Austria, Hungary, Italy, Norway, Sweden, Denmark and Spain. Some of these countries are disposed of in two or three pages.

About four hundred pages all told having been devoted to the various countries, approximately sixty are used for a comparative study of telephone rates and development in the various countries. Numerous comparisons are here made with the telephone industry of the United States. A portion of the space is used for chapter of conclusions.

It is interesting to note that after an experience with private ownership in Holland the general government bought the long-distance lines and then a number of the leading cities built exchanges. Although these cities had the right to buy out the private exchanges, the service rendered by these, the author states, had been so poor that the cities refused to buy out the companies, and accordingly built entirely [illegible] and had them ready to put into operation after the various concessions expired. [illegible] the plant pertaining to local exchanges [illegible] not be moved away had to be scrapped companies. It is also interesting to note [illegible] markable development of mutual local companies in Norway and Sweden to s[illegible] lages and adjacent rural sections. In [illegible] stances, the villages built and owned t[illegible] changes. This development was compar[illegible] many respects with that effected by mut[illegible] companies in various parts of the United [illegible]

Still another interesting point brought [illegible] the book is that where private owners[illegible] prevail for a time the governments and [illegible] palities insisted on consolidation of rival [illegible] companies prior to giving them further [illegible]

In some countries, notably Franc[illegible] governments adopted the policy of letti[illegible] private companies take all the risk of e[illegible] upon the new telephone industry, although [illegible] rently intending all the while to go into [illegible] ownership later on. These concessions in some instances were very short, being only five years in France, and consequently high rates and poor service resulted. France also early introduced the policy of compelling or inducing municipalities to build exchanges and also to contribute to the development of long-distance lines. In addition, the author states that France has not adequate accounting service for its telephone system and makes no annual reports of yearly operation. Even Germany merges its telephone accounts in a general budget. Switzerland is said to have the "most smoothly working public business organization" of any of the European countries which have gone into the telephone industry.

A material factor in the success of public ownership of telephones in Germany has been the influence of the German chambers of commerce. These, it appears, are encouraged by the government to make known their wishes for improved service, plans as to rates, etc., and thus afford a means of bringing to the ear of the government in a very effective manner just how the government telephone service is regarded by the users.

Mr. Holcombe does not make himself an advocate of public ownership, although one may infer that his sympathies are that way. He does, however, present an interesting mass of material from which others may draw their own conclusions, and he does not hesitate to draw conclusions himself regardless of whether these are favorable or unfavorable to government ownership in the country under consideration. Furthermore, he says "the historical truth is that the policy of private ownership *under public regulation* [italics ours] never had a fair trial"—in the countries under review.

Speaking in summary fashion he says elsewhere that Germany and Switzerland have maintained a telephone service adequate in quantity and satisfactory in quality, with rates which all in all have been satisfactory in Switzerland. In France the reverse is true as regards quantity and quality of service and rates. He also says that some of the countries have bungled the telephone business, while others have not bungled at all. The remarkable success which Germany has had with public ownership of telephones and the equally marked lack of success experienced in France he attributes largely to the character of the two peoples and their capacity for public administration.

The book as a whole is an interesting and valuable contribution to the literature of public ownership. Before dismissing it we cannot refrain from calling attention to the fact that in several instances the author was compelled to apologize for not giving American telephone figures later than 1902, explaining as his reason that, although the U. S. Census Bureau had collected figures for 1907 the report embodying those figures was not available when his book went to press. As the author's preface is dated Dec. 1, 1910, the long time taken to collect and publish these figures seems almost inexcusable, but we presume the Census Bureau had difficulties of its own which would partly explain and excuse the delay.

INTERSTATE COMMERCE COMMISSION.—Twenty-Fourth Annual Report, Dec. 21, 1910. (Edward A. Moseley, Secy.) Washington, D. C.: Pub. Doc. Cloth, 5¾ × 9 ins.; pp. 358.

This report is notable as the first issued since the passage of the Mann-Elkins law on June 18, 1910, which greatly enlarged the powers of the Commission. An impressive thing in the report is the great volume of work which the Commission has to perform. It may be summarized as follows: During the year the Commission has announced decisions in 692 proceedings where formal complaints were made against railway companies or were instituted by the Commission itself. Besides these, 125 cases were disposed without decision through withdrawal of complaint by the aggrieved party or agreement to dismiss. During the same time 660 formal complaints have been filed and 11 proceedings instituted by the Commission.

Besides all this, 25 proceedings involving suspension of a proposed increase in rates have been instituted. Some of these have attracted national attention and have involved an enormous amount of labor on the part of the Commission and its staff.

Besides these formal proceedings, informal complaints requiring correspondence were filed with the Commission to the number of 3,840 during the year.

All these various cases have involved 737 hearings and investigations with the taking of over 65,000 pages of testimony, besides many voluminous exhibits. During the year, also, 154,588 tariff publications were filed with the Commission.

Under the present law, express companies, sleeping-car companies, pipe lines, waterway carriers, telegraph and telephone companies and gas and electric corporations in the District of Columbia are all placed under control of the Commission.

To one who views these totals, representing the various responsibilities which are laid upon this Board of seven men, the remarkable thing is that they are able to perform so much and get such efficient results in the control and betterment of railway operations.

Appendix D of the report relates to "Safety Appliances." The table shows that 436,600 freight cars, 15,000 passenger cars and 22,000 locomotives were inspected last year. Defects were found in from 4½ to 6½% of the railway stock inspected. The most frequent defects were in air brakes. It is exceedingly encouraging to note the great reduction in the percentage of defects which has taken place in the past five years as shown by the following table:

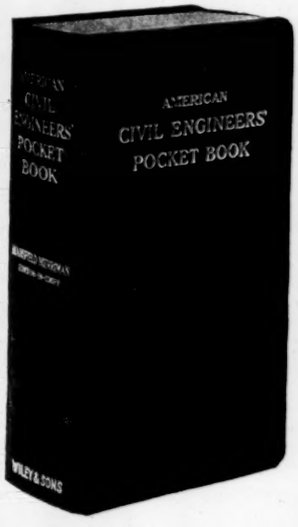
NUMBER OF DEFECTS PER 1,000 CARS INSPECTED.

	1910.	1905.
Couplers and parts	4.39	23.06
Uncoupling mechanism	7.55	95.07
Air brakes	36.89	131.22
Handholds	12.89	42.89
Ladders	.6	3.87
Sill steps	1.85	12.14
Height of couplers	1.13	1.66
All classes	65.33	309.56

While the defects in air brakes have been greatly reduced as shown, the Chief Inspector makes interesting remarks concerning the failure of certain railways to maintain brakes in effective condition. He says that "trains frequently leave their terminal without an air test, in charge of crews not one of whom knows anything about the condition of the air-brake equipment."

Certainly any railway company which countenances such methods of operation ought to be supervised by some public authority and supervised with vigorous decision.

Besides all this work, the Commission is instrumental in securing to shippers refunds of excessive charges paid. Pages 193-354 of the report contain a list of the complaints made to the Commission in which a refund was authorized informally on account, in almost every case, of the charge of excessive rates. The cases listed number several thousand, and it appears that shippers of every class, from the United States Steel Corporation down to private individuals, are utilizing the machinery of the Commission to obtain refunds of excessive charges from railway companies. While in most cases the amounts refunded are small, there are a few cases in which the amount refunded was above two thousand dollars.



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HYDRO-ELECTRIC PRACTICE.—A Practical Manual of the Development of Water Power, Its Conversion to Electric Energy, and Its Distant Transmission. By H. A. E. C. von Schon, Civil and Hydraulic Engineer; M. Am. Soc. C. E. Second edition. Philadelphia: Pa., and London: J. B. Lippincott Co. Cloth; 7¼ × 10 ins.; pp. 383; 237 illustrations in text and 33 tables. $6, net.

The first edition of this book was reviewed in Eng. Lit. Sup., Nov. 12, 1908, by Mr. F. C. Finkle, of Los Angeles. This second edition shows that the criticisms of Mr. Finkle, and others, have been accepted by the author in part, to the material improvement of the book. At the same time some of the former weaknesses are still apparent and indeed if all the recommended changes had been made a new book, rather than a revised edition, would have resulted.

The first edition had considerable value to any practicing hydraulic or electrical engineer and the revised edition has still more. But the chief field for it lies still in instructing the younger men, occupying subordinate positions, as to the part their present work plays in the development of a power development and as to the general scope which their future studies must cover if they are to become prominent power-development specialists.

The first part of the book gives a hasty summary, or a brief review, of the steps an engineer takes in examining and reporting upon a proposed development. The details of some of the work are given in the second and third parts devoted respectively to design and construction and to operation.

Almost 40% of the book is taken up by Chapter VIII., on "Structural Types," which includes descriptions of various dams, foundations, cofferdams, superstructures, spillways, abutments, reservoirs, flashboards, sluices, etc., etc. Some of this chapter, as in the previous edition, is complete and good, but much is said about spillway design, for instance, which is found elsewhere in recognized authorities. The presentation of the analyses of dam construction and selection of type of power-house, has been improved, by including brief remarks on conditions which fix one type or another. The utility of any such remarks is necessarily somewhat limited, since in the last analysis they must fall back on the engineer's judgment of the effect of investment, maintenance and service factors.

The author seems not to have been able to profit by Mr. Finkle's suggestions that the discussion of elementary principles of turbine design should turn aside from the descriptions, which may be found in trade literature, to a summary of mechanics of design, principles underlying the inter-relations of power, speed, efficiency, losses, erosion, etc. Impulse wheels and high head developments generally have been neglected.

The small part of the volume devoted to electrical matters gives only a very general, though adequate, outline of the theory and phenomena of electrical energy flow and potential generation. This, of course, is sufficient so far as the design of generators, transformers, motors, lamps, etc., needs to be considered, but more should have been said about the design of transmission lines. What is said about things directly in the hydro-electric plant engineer's province is still insufficient and not up-to-date. There is by no means enough said to permit a safe opinion about the conditions which demand high or extra-high voltage transmission, for instance, or on the economics of steel towers vs. wood poles, or as to what relation shall exist between transmission losses and line investment.

Arrangements have been made for the publication of a life of the late Mrs. Ellen H. Richards. The life will be edited by Miss Caroline L. Hunt, 32 Eliot St., Jamaica Plain, Mass. It is requested that there be sent to Miss Hunt "any materials, such as letters, photographs, characteristic sayings and incidents, which will help to show her far-reaching interests and activities." The project has the approval of Prof. Robert H. Richards, the husband of Mrs. Richards.

SEWAGE EXPERIMENTS AT PHILADELPHIA.—Partial Report upon the Comprehensive Plan for the Collection, Purification and Disposal of the Sewage of the Entire City; Comprising the Work at the Sewage Experiment Station at Spring Garden, Philadelphia, 1910. Philadelphia, Pa.: Bureau of Surveys. Boards; 6 × 9 ins.; pp. 204; photographic views, 41 diagrams and 76 tables.

During 1909-10 a series of experiments on modern methods of sewage treatment was carried on in behalf of the City of Philadelphia for the purpose of obtaining local information of use in complying with an order of the State Department of Health to submit to the Department comprehensive plans for the treatment of the sewage of Philadelphia. This report recounts in detail experiments with screens, settling tanks of the ordinary and also of the Imhoff or Emscher type, intermittent sand filters, contact beds, including Dibdin slate bed, sprinkling filters, including one of the so-called Hamburg type after the design of Dr. Dunbar, disinfection, and also studies in the dilution of sewage which had been passed through a fine screen and treated with sufficient calcium hypochlorite to yield six parts per million available chlorine. The report is accompanied by many tables and diagrams and a few half-tone reproductions of photographs of various portions of the experiment plant.

It should be added that the experiments were conducted under the general direction of Mr. Geo. S. Webster, M. Am. Soc. C. E., Chief Engineer and Surveyor, Bureau of Surveys, and under the supervision of Mr. Geo. E. Datesman, M. Am. Soc. C. E., Principal Assistant Engineer. Mr. Wm. L. Stevenson, Assoc. M. Am. Soc. C. E., was Assistant Engineer in charge, and Mr. Geo. G. Eysenbach was Chemist.

A valuable feature of the report is a prefatory "Summary of Conclusions" which gives in seven pages the gist of the report. Marginal references are used to indicate the page on which will be found the data on which the various points in the summary of conclusions were based. The summary just named, together with the general outline of the testing station, were printed in Engineering News on April 27, 1911.

CHRYSOTILE-ASBESTOS.—Its Occurrence, Exploitation, Milling and Uses. By Fritz Cirkel. Second edition enlarged. Canada Department of Mines, Mines Branch, Hon. W. Templeman, Minister. Ottawa, Can.: Pub. Doc. Stiff paper; 7 × 10 ins.; pp. 316; 88 figures in text; 66 plates; 2 maps.

While this is in form a government report, it is actually a very thorough and very valuable treatise on the production and use of asbestos. The treatment is thoroughly scientific, but the report is written in a style which makes it exceedingly interesting reading.

It is not generally realized by engineers, we presume, how recent is the commercial development of asbestos. Practically the entire asbestos industry began no longer ago than 1878, and within the last half dozen years an enormous increase has taken place in asbestos production and utilization. The work is profusely illustrated, and is replete with statistical information and accurate technical records. It ought to be in every engineering library as the best reference book on asbestos obtainable.

SURVEY OF NORTHERN AND NORTHWESTERN LAKES.—Bulletin No. 20. War Department, Corps of Engineers. Detroit, Mich.: U. S. Lake Survey Office. Paper; 7¾ × 10 ins.; pp. 400.

The information compiled in this bulletin is intended chiefly for the use of navigators on the Great Lakes. It is a complete revision of former bulletins and contains data from surveys made by the U. S. Lake Survey, annual and special reports of the officers of the Corps of Engineers, U. S. A., publications of the U. S. Bureau of Lighthouses, and information furnished by the Canadian Departments of Marine and Fisheries, Public Works, and Railways and Canals. The bulletin is intended to supply detailed descriptions of shore line and shoals, river and harbor improvements, results of surveys, and the particulars of the constantly changing conditions on the Great Lakes, which cannot be fully shown on the charts. It is issued free of charge to navigators and other chart purchasers.

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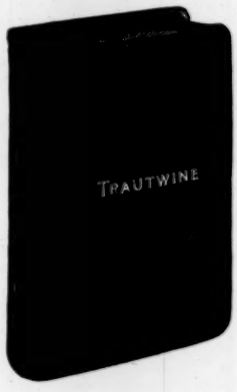

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School-Building Hand Book.

AMERICAN SCHOOL BUILDING STANDARDS.—By Arthur T. Mills, Architect, A. A. I. A. Columbus, O.: Franklin Educational Publishing Co. Leather; 7 ins.; pp. 324; illustrated.

This is here brought together a considerable variety of information regarding the design and construction of school buildings, including also abstracts of state legislation and state and city regulations governing the subject. The school house as a unit, the school building and special rooms are each given brief chapters. Sanitation, with more particular reference to plumbing, is discussed, and there are chapters on "Fireproofing and Panic Proofing" and on both heating and ventilation. Abstracts of school laws and regulations of various states occupy 50 pages, and a full reprint of "The Standard Code of the Boston School House Commission" takes up 35 pages in addition. There is a chapter on the selection of an architect, in which the pros and cons of competitions are discussed, and in another part of the book there is a "Form of Program for Computations," the latter occupying 13 pages. The "Canons of Ethics" and "Schedule of Minimum Charges" of the American Institute of Architects are given.

The remaining 90 pages is made up wholly of illustrations, including plans and half-tone reproductions of photographs of a considerable number of school buildings (a few of which were designed by the author); line drawings of a considerable variety of school house fittings; and half-tones of various sanitary fixtures and heating and ventilating apparatus, mostly reproductions of wash drawings from trade catalogs. Scattered through the text there are a number of line drawings. Many of the line sketches and diagrams in the appendix and a full-page collection in the text are rendered of little use because the dimensioning and lettering is barely legible. In fact, with the exception of the floor plans, the lettering on nearly all the drawings in the appendix is very poor. This is a pity because otherwise the author has done remarkably well in the way of presenting a mass of details in small space. The lettering might readily enough have been made perfectly legible by a person experienced in lettering drawings for reproduction.

Broadly speaking, those parts of the book which are not made up of abstracts or reprints of state and local legislation and other rules and regulations consist of general reviews of the topics treated without attempts to go very much into detail. General principles are stated, as well as certain things to be avoided. The author in several instances refers to monographs for more detailed information. His apparent attempt has been to present in small compass some of the leading features of school-building design, as well as the gist of the legislation on the subject thus far enacted in this country. Judged from this point of view, the book seems to be satisfactory.

WELL-DRILLING METHODS.—Water-Supply Paper 257. By Isaiah Bowman. Department of the Interior, U. S. Geological Survey. (George Otis Smith, Director.) Paper; 6 × 9 ins.; pp. 139; 25 figures in text. Washington, D. C.: Pub. Doc.

Considering the great extent to which drilled wells of various sorts are relied upon for water-supplies large and small, the number of books and pamphlets on well-drilling is surprisingly small. The author herein appears to have made a successful attempt, considering the space available, to cover his chosen subject. Information is given on underground waters of the United States and water, oil and gas bearing formations. This is followed by a history of well drilling, on which a little is said as regards Asia and Europe and much more regarding the art in the United States. Some five pages are given to the cost of well sinking. Methods of well drilling are then described in considerable detail. A limited number of well chosen illustrations are presented.

In closing, the author gives a list of ten drill manufacturers and supply companies located in various parts of the United States which have furnished information for his use in preparing the monograph. One of his reasons for giving such a list is that "most of the firms handling such machinery do not advertise in the engineering journals."

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Evils of Our National Appropriation Methods.

THE COST OF OUR NATIONAL GOVERNMENT.—A Study in Political Pathology. By Henry Jones Ford, Professor of Politics in Princeton University. New York: The Columbia University Press. Agents: Lemcke & Buechner (30 W. 27th St., N. Y.). Cloth; 5¼ × 8 ins.; pp. 147. $1.50, net.

The first few pages of this book give the impression that the author is merely following the too common practice of other critics of governmental expenditures by inveighing against their rapid increase without taking into account either the causes of the increase or the resulting benefits. It soon becomes evident, however, that the author is not so much decrying increased expenditures as pointing out the great wastes and extravagances which go on unchecked at many points, and the utter lack of effective means of adjusting expenditures to revenues.

The volume is based on lectures delivered at Columbia University in the fall and winter of 1909. The author first takes up briefly the growth of governmental expenditures and then deals with what in brief may be termed the national budgetary system of the United States, or, more properly, the lack of system as compared with other nations of the world. Our wastefulness and extravagance in the matter of governmental expenditures are very largely caused, the author shows, by the fact that we have no centralized or unified system of control of national finances. Instead, appropriations are made by independent congressional committees and by one means or another are largely controlled by local and private interests. In practically all other countries of the world, except the United States and the countries of South America, the executive department of the government formulates a budget. Consequently, appropriations for various governmental departments are considered in their relations to each other and to the needs of the country as a whole, with the result that "log rolling" and the "pork barrel" are unknown.

The blame for the present state of affairs in this country rests largely upon the system in vogue, which virtually permits the Senate to control the appropriation bills, although, according to a strict interpretation of the constitution, the making of appropriations is the function of the House of Representatives alone. The House does not assert itself to rectify the use of this system, because individual members in both parties profit by it. When they fail to secure appropriations which are more or less of a personal character they rely upon some senator to insert the desired item in the appropriation bill, and through "personal privilege" or "senatorial courtesy" a senator or group of senators can succeed in getting almost any item into an appropriation bill by holding up the alternative of defeating it entirely.

Besides restoring the appropriating power to the House and bringing the control of all appropriations back into one committee, as was originally the case, there is great need of strong executive control of appropriations both through the formulation of the budget by the executive department or the President and by applying the veto power to specific items. The author gives reason to believe that there is constitutional warrant for the veto of specific items. The exercise of this power would demand not only great courage and determination on the part of the President but also a favorable political relationship between the President and the two branches of Congress.

Though drastic reforms or a national catastrophe will be the alternative before many decades, the author believes he sees signs which give reason to believe that our appropriation system may be reformed and waste and extravagance prevented, or at least materially reduced, by evolution rather than by revolution.

Some interesting statistical appendixes show the increases in our national, state and local expenditures over a long series of years, and give other interesting and valuable information regarding the appropriation system of the United States. One of the tables presented shows that although per capita federal expenditures have increased many fold during the past century, yet the expenditures in relation to wealth have decreased in the last fifty years. This conclusion, however, is based on figures showing the national expenditures payable from taxes.

The book is so brief, readable and suggestive as to warrant recommending it to a wide circle of readers, even in these days of many books, which make appeal to the earnest-minded person.

POWER AND ITS TRANSMISSION.—A Practical Handbook for the Factory and Works Manager. By Thomas A. Smith. New York: Spon & Chamberlain. London: E. & F. N. Spon, Ltd. Cloth; 4 × 6½ ins.; pp. 76; tables. 2s., net; American price, $1, net.

The author's aim in preparing this little book was very good. A handy, concise little guide to safe practice and useful information about belts, shafting, pulleys, drives, lubrication, etc., probably would have been appreciated. The author's execution of the work might better be termed "murder," especially as regards the subjects of gas and electric power.

The author cautions that the distance between bearings of shafting should not exceed 30 diameters. American practice agrees with the author's tables, presumably based on such rules, only for the largest sizes (about 8 ins.) rarely used by one apt to need this book. For a 3-in. shaft the author demands 8 ft., where we would permit 11 ft. The horsepower which shafting can transmit is given for "iron" and "steel" in different diameters. The figures for iron are some 33% greater than considered advisable in this country for good cold-rolled steel, which presumably is much stronger than the author's indefinite "iron" or "steel." For "steel" the tables give from 60 to 100% greater loads than would be imposed here.

There are a couple of pages on lubricating oils. Here the author makes some very positive statements, such as: (1) that oil to lubricate bearings, slides, and rubbing surfaces should be invariably pure mineral oil, devoid of animal or vegetable fat; (2) that vegetable oils have no lubricating properties whatever; (3) that a compounded engine oil should not be accepted at any price; (4) that no vegetable oil should be used in a cylinder oil—8 to 10% of acidless tallow alone being permitted.

Contrasted with these statements are those in the American authority on oils, "Oil Analysis," by Prof. A. H. Gill. Here we find where olive, rape, cottonseed, linseed and the heavy vegetable oils find service quite in opposition to the foregoing "dont's."

A GUIDE TO READING IN SOCIAL ETHICS AND ALLIED SUBJECTS.—Lists of Books and Articles Selected and Described for the Use of General Readers. By Teachers in Harvard University. Cambridge, Mass. Harvard University. Boards; 5¾ × 8¾ ins.; pp. 266. $1.25 ($1.38 postpaid); Paper, $1 ($1.10 postpaid).

A useful list of books by nearly if not quite 500 authors is here presented. Each entry is generally accompanied by brief description and critical comment. In the selection of books for inclusion, the aim of the compilers was careful selection from representative books rather than completeness.

The books listed are grouped under the main subjects of philosophy, institutions, service, modern industry and religion, all, of course, in their social aspects. In addition, there is a list of biographical works. Under each of these there are a number of sub-topics, including Social Statistics, contributed by William Z. Ripley; the Science of Government by William B. Munro; Taxation by Charles J. Bullock; Housing and Town Planning by James Ford; Municipal Ownership by Arthur M. Holcombe; and Profit Sharing and Industrial Betterment by James Ford.

In selecting the sub-topics, the line seems to have been drawn just short of sanitary engineering topics, the nearest approach being "Medical Aspects of Sociology." A few of the compilers, instead of giving comments of their own on books listed, substituted extracts from the books themselves, which as a rule is hardly as satisfactory as the other plan. The value of the work would have been increased had prices been inserted for each book listed.

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Scientific management has recen received a great deal of attention the daily press and general magazin One important newspaper made the e itorial comment that no developme in the world of engineering has ev arrested public attention to the sam degree as has the new science of ma agement, or management engineerin The first book published on this su ject is

"Cost Keeping and Management Engineering"

By Halbert P. Gillette and Richard T. Dana, Members American Society of Civil Engineers.

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Prof. T. S. Hewerdine, Dear Sir:—I have been making a very lonesome fight for sound and rational engineering in steel and concrete structures. I am sending you a copy of my book, "Concrete." * * * If you see anything in the book that adds $2.50 to the value of knowledge in reinforced concrete, you may send me the price; if not, the book is yours with my compliments. * * * I anticipated the worst that reviewers have dealt me. Ten years, or perhaps not until twenty have passed, the literature on this subject will have quite a different complexion. Yours sincerely, Edward Godfrey.

Mr. Edward Godfrey, Dear Sir:—Your interesting letter received, also your book "Concrete." I am well pleased with your ideas and appreciate your efforts to simplify reinforced concrete design. I have been working along very similar lines and endeavored to eliminate some of the theoretical nonsense. * * * I have attacked some of the hypotheses of sanitary engineering. * * * I appreciate your book "Concrete" and it is well worth the $2.50, which I enclose. Yours truly, T. S. Hewerdine.

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RAILWAY STATION SERVICE.—By B. C. Burt, Ph. D., ... the "Northwestern Line." New York: John ... & Sons. London: Chapman & Hall, Ltd. ... 5 × 7½ ins.; pp. 292. $2. net.

The business or service of a railway is commonly described as that of transporting passengers and freight. Mr. Burt points out that (to be more precise) it is transportation from and to specific points, or stations. The station is not a mere subordinate feature of the railway; on the contrary it is one of its most essential parts since here the business is originated and distributed. The first few chapters therefore deal with the station in its relation to the railway system, and with the various necessary and ancillary facilities required by stations of different character and importance. One chapter deals also with rolling-stock equipment.

For the rest, the book deals mainly with the work, duties and responsibilities of the station agent and station staff. In reading this part of the book one cannot but be impressed by the multifarious duties imposed upon the ordinary station agent, and the important position which he occupies in relation to the welfare of the railway by acting as its direct and personal representative in dealing with the public (whether as shippers or passengers). The matters of freight and passenger rates and business, tickets, way bills, local and through billing, sealing cars, train switching, handling stock and perishable goods, car supply, records and reports, accounting, etc., are all covered, together with numerous other subjects. The complicated nature of the service is further evidenced by the fact that not only has the station (and its representative) a varied list of duties, but that in its relation to the company it has to deal with several different departments (such as the traffic, operating, accounting, claim, legal and other departments).

The book is of particular value for the training and instruction of employees, and for the use of the student of railway matters. But its underlying purpose is to set forth distinctly the importance of the station as an entity or a unit in the railway system, and the relation of the station service to railway service in general.

INDEX TO SIGNAL LITERATURE.—Vol 1., October, 1910. Bethlehem, Pa.: Railway Signal Association. Cloth; 6 × 9½ ins.; pp. 185. $1, net.

The remarkable development in signaling on American railways during the past few years (which development includes both the extensive adoption of signaling and the improvement of signal apparatus) has been accompanied by a large amount of literature on the subject. This includes papers, books, reports and numerous contributions to the technical press. To look up such published matter on any particular subject would be a tedious task, and in view of the great importance of the subject in general the Railway Signal Association has done valuable service in compiling this "Index." There is first an index of authors and then a classified index by subjects. Appendices give (1) a list of technical institutions (including correspondence schools) and the attention which they give to instruction in signaling; (2) the methods employed by different railways for training employees in the signal department. It may be noted that the index includes the publications of the signal companies, many of which are of special importance in describing particular systems or appliances.

STATE ENGINEER, COLORADO.—Fifteenth Biennial Report to the Governor, 1909-10. (Charles W. Comstock, State Engineer.). Denver, Colo.: Pub. Doc. Paper; 9 × 12 ins.; pp. 341; illustrated.

Besides the usual large amount of routine information regarding the control of the distribution of water for irrigation purposes in various parts of the State, this volume contains a considerable amount of interesting matter on dam and reservoir failures, many tables of stream-flow data and a brief preliminary report on the hydrography of the Yampa Basin, the latter by Mr. Charles L. Chatfield, Hydrographer of the State Engineer's office. The volume also contains a little information on irrigation districts in the State, a review of reservoirs under construction, approved plans for reservoirs and three or four pages giving some analysis of material used in dam construction.

The thirty pages on reservoir failures and reconstruction contain a considerable amount of interesting information and a number of suggestions to to "how not to do it." This portion of the report indicates that the filing of plans in the State Engineer's office before entering on the construction of dams and reservoirs has amounted to but little in a number of instances, except to put on record scanty information of possible use in studying failures. The report does not make it clear why the official records do not show whether plans for structures which have failed had ever been approved by the State Engineer. The presumption is that through oversight or negligence in filing no action on the plans was ever taken, although it may be that through carelessness no record was made of approval or disapproval.

The size of page chosen for this report may perhaps add to the dignified appearance of the volume, but it is certainly awkward, and the very great length of the lines of text (7⅝ ins.)

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is certainly not conducive to easy reading. Some of the tables may seem to demand a large page, but there are none that might not have been compressed or rearranged so as to have come into a large octavo page, with a gain not only in space but in ease of use. Some of the pages with half-tones look awkward on account of the abnormally wide margins.

How to Raise Tree Crops.

THE PRINCIPLES OF HANDLING WOODLANDS.—By Henry S. Graves, Chief Forester, Forest Service, U. S. Dept. of Agriculture. New York: John Wiley & Sons; London: Chapman & Hall, Ltd. Cloth; 5½ × 8¼ ins.; pp. 325; 63 figures in text. $1.50, net.

Thus far America has been acting as though all it had to do when it wanted lumber of any sort was to go out and cut down a single tree or a million trees, according to its needs, without any regard to replenishment. The time has now come when it should be recognized that whenever a tree is cut down another one should be provided for to take its place. It is from this point of view that Mr. Graves has written the book before us.

The general scope of the book is thus expressed in a paragraph which we take from the preface:

> The book deals primarily with the principles of cutting mature stands of timber with a view to their replacement by new growth; cuttings in immature stands made for their improvement; and forest protection, with particular reference to forest fires. The book is not intended as a complete treatise on silviculture, but deals only with the treatment of woodlands. The methods of artificial seeding and planting are not included at all. This is an extensive subject in itself and is left to be handled by another author.

After a brief introductory chapter, in which the author surveys his field, some of the general principles involved in the various systems of cutting are taken up. These include selection, clear-cutting, shelterwood and coppice systems. A chapter is then devoted to the "Improvement of the Forest" by means of various kinds of cuttings and thinnings, according to special conditions. Nearly a third of the book is devoted to the protection of forests from fire (85 pages) and from other injuries (10 pages), including insects and fungi.

The book is written in a clear and interesting manner and is free from technicalities. It suffers from repetition, but not seriously. The illustrations are mostly half-tone reproductions of photographic views which generally give emphasis to points made in the text. A few well-selected and well-presented line drawings are used. The book promises to be a valuable addition to American forestry literature. It deserves careful reading and attention by all who have woodlands within their control or who, not being so fortunate as to own wooded land themselves, are in a position to influence others in its care and management.

MILITARY TOPOGRAPHY FOR THE MOBILE FORCES.—Including Map Reading, Surveying and Sketching. By Capt. C. O. Sherrill, Corps of Engineers, U. S. Army; Instructor in the Department of Engineering, U. S. Service Schools, Fort Leavenworth, Kans. Second edition. Fort Leavenworth, Kans.: The U. S. Calvary Association. Cloth; 5½ × 8½ ins.; pp. 353; one folding map, 154 text figures and three tables. $2.50, net.

The ability to construct and to read maps is one of the most important requisites of an army officer's education, for upon that ability the whole disposition of an army or the plan of a battle may at some time depend. To supply this need the U. S. Army Service Schools at Fort Leavenworth, Kan., are provided with a special course in military topography for which this book is the text, and its success there has led to its adoption in the garrison schools as a basis for promotion examinations and by the militia. While containing much that is in the ordinary text-book on surveying, its special field is military map reading and rapid map sketching. This latter subject is remarkably well treated and should serve as an aid to a civilian engineer who wishes to study the methods of fast and easy, but complete, reconnaissance map-work as well as to the military engineers for whom it is primarily designed. Exactly the same subject matter is not contained in any other book, so far as our knowledge extends.

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THE TEMPERATURE-ENTROPY DIAGRAM.—By Charles W. Berry, Assistant Professor of Mechanical Engineering, Mass. Inst. of Tech. Third edition, revised and enlarged. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5 × 7½ ins.; pp. 393; 125 illustrations in text. $2.50, net.

The successive editions of Prof. Berry's very useful text show a decided tendency toward expansion. The second edition, as noted in this Supplement Dec. 17, 1908, p. 695, was double the size of the first and this third edition just falls short of having twice as many pages as the second. Naturally the scope and treatment have grown but the author has endeavored to stick to the title and his main discussions relate to the use of temperature-entropy graphs in the study of energy changes and efficiency of the many processes of modern power apparatus, particularly boilers, steam engines and turbines, gas engines, economizers, heaters, compressors, and refrigerating machinery. At the same time there continues throughout, a running comment on certain practical points that limit or modify the application of theory.

INDUSTRY AND PROGRESS.—Addresses Delivered in Duke Lecture Series, 1910, before the Senior Class of the Sheffield Scientific School, Yale University. By Norman Hapgood. New Haven, Conn.: Yale University Press. London: Henry Frowde, Oxford University Press. Cloth; 5 × 8 ins.; pp. 123. $1.25.

Mr. Hapgood speaks very earnestly and forcibly on the problems surrounding industrial life, particularly problems of how to give the worker a fair share of the production yield and how to proceed wisely in governmental regulation of the employer-employee relations. Hours of labor, wage-rates, sanitary control of factories, and workmen's compensation are handled very well in the first chapter on "Employment." Unionism is the theme of the second chapter, "Labor," but the discussion leads to nothing definite. The third chapter "Production," treats heterogeneously of the contrast between modern and ancient production, wastefulness, efficiency, "scientific management," and corporation control. The two last chapters, "Distribution" and "Progress," are less instructive than the others.

Mr. Hapgood evidences a deep, sympathetic insight into sociological matters, and is best in the passages which treat of problems of sociology.

VACUUM CLEANING OF SCHOOLHOUSES.—By Thomas D. Perry. Milwaukee, Wis.; American School Board Journal. Paper; 4½ × 6¼ ins.; pp. 44; illustrated. 15 cts. per copy, postpaid.

Here is an interesting little reprint of a series of articles which originally appeared in the American School Board Journal. It describes common suction pumps, piping layouts, tools, etc. There is also a description of a scheme for making comparative tests of various cleaners, developed at Grand Rapids, Mich. Skeleton outline specifications are given for the apparatus needed in a 12-room school building.

REPORT OF THE STATE GEOLOGIST OF VERMONT.—1909-1910.—Geo. H. Perkins, Ph. D., State Geologist. Cloth; 6 × 9 ins.; 71 plates and 31 figs.; 361 pp.

This report is notable for its account of the granite industry of Vermont which, beginning with less than $60,000 value in 1880, has now reached an annual output worth some $3,000,000. Some tests of granite showing an ultimate compressive strength of 34,350 lbs. per sq. in. are recorded.

THE WAR MAKER.—Being the True Story of Captain George B. Boynton. By Horace Smith. Chicago, Ill.: A. C. McClurg & Co. Cloth; 5½ × 8¼ ins.; pp. 414; portrait. $1.50, net.

This purports to be the true story of a soldier of fortune, as set down almost exactly as it was given to the author shortly before the death of the hero, early this year. The book contains a vivid account of the deeds of a typical latter-day man of adventure, under the service of various South American republics, and in filibustering, blockade-running and piratic expeditions, during the years from 1860 to 1905. The narration is in the first person, in a style well adapted to the character of the adventurous hero, and in a manner not high-flying but as straight forward as Captain Boynton himself.

CONCRETE WORKER'S REFERENCE BOOKS.—By A. A. Houghton, Author of "Concrete from Sand Molds," "Ornamental Concrete Without Molds," etc. No. 3: Practical Silo Construction. No. 4: Molding Concrete Chimneys, Slate and Roof Tiles. No. 5: Molding and Curing Ornamental Concrete. No. 6: Concrete Monuments, Mausoleums and Burial Vaults. New York: The Norman W. Henley Publishing Co. Stiff paper; 5 × 7¼ ins.; pp. 69, 61, 58, 65; illustrated. 50 cts. each, net.

These four books are the latest additions to the set of books for the use of practical concrete workers in the various applications of the material. They are not intended to be more than working manuals for the simpler forms of concrete, and as such they maintain the satisfactory standard of their predecessors.

Publications Received.

ADOBE AS A BUILDING MATERIAL FOR THE PLAINS.—By J. W. Adams. Bulletin No. 174, November, 1910, the Agricultural Experiment Station of the Colorado Agricultural College. Fort Collins, Colo.: The Experiment Station. Paper; 6 × 9¼ ins.; pp. 8; illustrated.

DER AUSBAU DER NIEDERDRUCKWASSERKRAEFTE.—By Adolph Ludin, Grossh. Regierungsbaumeister. Heidelberg: Universitäts-Buchdruckerei von J. Hörning. Paper; 6¼ × 9¼ ins.; pp. 216; nine plates, 37 text figures and eleven tables.

THE BREMEN OIL FIELD.—By J. A. Bownocker. Fourth series, Bulletin No. 12, Geological Survey of Ohio; J. A. Bownocker, State Geologist. Columbus, Ohio: Pub. Doc. Cloth; 6¼ × 9¾ ins.; pp. 68; six plates (four folding).

THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Report of Annual Meeting, 1911. Vol. XXV. Montreal, P. Q.: The Society, 413 Dorchester St. West. (C. H. McLeod, Secy.) Paper; 6 × 9 ins.; pp. 186.

CHEMISTRY FOR BEGINNERS.—I. Inorganic. By Edward Hart, Ph. D., Professor of Chemistry, Lafayette College, Easton, Pa.; Ex-Fellow Johns Hopkins University. Fifth edition, revised and enlarged. Easton, Pa.: The Chemical Publishing Co. London: Williams & Norgate. Cloth; 5¼ × 7 ins.; pp. 214; two plates, 78 text illustrations. $1, net.

COST-KEEPING FOR MANUFACTURING PLANTS.—By Sterling H. Bunnell, Ph. B., M. E.; M. Am. Soc. M. E., Assoc. M. Am. Gas Inst. New York: D. Appleton & Co. Cloth; 6 × 9½ ins.; pp. 232; 37 figures in text. $3, net.

COMMISSIONER OF EDUCATION.—Report for the Year Ended June 30, 1910. Vol. II. Department of the Interior. Washington, D. C.: Pub. Doc. Cloth; 5¾ × 9¼ ins.; pp. 684; tables.

COMMONWEALTH BUREAU OF CENSUS AND STATISTICS, MELBOURNE (Australia).—Geo. H. Knibbs, C. M. G., Commonwealth Statistician. Bulletin No. 4. Melbourne: Pub. Doc. Paper; 8¼ × 13 ins.

Production. Summary of Commonwealth Production Statistics, 1901-1909. Pp. 128.

Transport and Communication. Summary of Commonwealth Statistics of Transport and Communication, 1901-1909. Pp. 40.

DEPARTMENT OF FINANCE AND MUNICIPAL ACCOUNTS (Iowa).—Annual Report by Auditor of State (John L. Bleakly). Statistics of Cities and Towns of Iowa, March 31, 1910. Des Moines, Iowa: State Doc. Cloth; 5¾ × 9 ins.; pp. 367; tables.

DEPARTMENT OF PUBLIC WORKS, PROVINCE OF SASKATCHEWAN.—(Hon. Walter Scott, Minister of Public Works.) Report for 1909-10, Ending Feb. 28, 1910. Regina, Sask.: Pub. Doc. Paper; 6¾ × 10 ins.; pp. 170; illustrated.

DICTIONARY OF ENGLISH AND SPANISH TECHNICAL AND COMMERCIAL TERMS.—Used Principally in the Iron, Steel, Hardware and Engineering Trades. By William Jackson. London: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain. Cloth; 4 × 6¾ ins.; pp. 164. $1, net.

FOREST POLICY.—By C. A. Schenck, Ph. D., Director Biltmore Forest School, Late Forester to the Biltmore Estate and Oberfoerster in Hesse-Darmstadt. Second edition, revised and enlarged. Asheville, N. C.: Biltmore Forest School. Paper; 5¾ × 8¾ ins.; pp. 168. $1.75, net.

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FROM ROUGH RIDER TO PRESIDENT.—By Dr. Max Kullnick. Translated from the original German by Frederick von Reithdorf, Ph. D., Professor of Modern Languages, Monmouth (Ill.) College. Chicago, Ill.: A. C. McClurg & Co. Cloth; 5½ × 8½ ins.; pp. 289; frontispiece. $1.50, net.

HOME WATERWORKS.—A Manual of Water Supply in Country Homes.—By Carleton J. Lynde, Professor of Physics in MacDonald College, Quebec. New York: Sturgis & Walton Co. Cloth; 5 × 7½ ins.; pp. 270; 106 text figures. 75 cts., net.

THE HYGIENE OF PUBLIC CONVEYANCES.—By S. Adolphus Knopf, M. D., New York, Professor of Phthisiotherapy at the Post-Graduate Medical School and Hospital; Assoc. Dir. of the Clinic for Pulmonary Diseases of the Health Dept.; Visiting Physician to the Riverside Hospital-Sanatorium for Consumptives of the City of New York. Reprinted from the "Medical Record," March 18, 1911. New York: William Wood & Co. Paper; 5 × 7¾ ins.; pp. 19.

A GENERAL FORMULA FOR THE SHEARING DEFLECTION OF BEAMS OF ARBITRARY CROSS SECTION, EITHER VARIABLE OR CONSTANT.—By S. E. Slocum, B. E., Ph. D., Professor of Applied Mathematics, University of Cincinnati. Reprinted from the Journal of the Franklin Institute, April, 1911. Cincinnati, Ohio: The Author. Paper; 6 × 9 ins.; pp. 24.

ILLUMINATING ENGINEERING.—Lectures Delivered at the Johns Hopkins University October and November, 1910, under the joint auspices of the University and the Illuminating Engineering Society. Vols. I. and II. Baltimore, Md.: The Johns Hopkins Press. Cloth; 6 × 9¼ ins.; pp. 1,052; 115 text figures. Subscription price, $5 per set.

INDIANA SANITARY AND WATER SUPPLY ASSOCIATION.—Proceedings of the Annual Convention Held at Claypool Hotel, Indianapolis, Ind., Feb. 9-10, 1911. Indianapolis, Ind.: The Association (W. F. King, M. D., Secy.) Paper; 6 × 9 ins.; pp. 166.

AN INVESTIGATION OF RECENT OUTBREAKS OF TYPHOID FEVER IN AN ADIRONDACK CAMP, AND THE DISCOVERY OF A TYPHOID CARRIER.—By Charles E. North, M. D., New York. Reprinted from the "Medical Record," March 25, 1911. New York: William Wood & Co. Paper; 4¾ × 7½ ins.; pp. 22; two illustrations.

JOURNAL OF THE ROYAL SANITARY INSTITUTE.—Course of Lectures on Army Sanitation. By Lieut.-Col. C. H. Melville, M. B., C. M., D. P. H., Professor of Hygiene, Royal Army Medical College (Fellow). Vol. XXXII., No. 3, April, 1911. Published monthly. London: The Institute. Paper; 7 × 10¼ ins.; pp. 48; seven text figures. 1s., net; American price, 40 cts., net.

LANDSCAPE GARDENING.—How to Lay Out a Garden. By Edward Kemp, Landscape Gardener. Edited, revised and adapted to North America by F. A. Waugh, Professor of Landscape Gardening, Massachusetts Agricultural College. Fourth edition. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 5 × 7½ ins.; pp. 292; 20 plates and 79 illustrations in text. $1.50, net.

LOCATION OF SEWER OUTLETS AND THE DISCHARGE OF SEWAGE INTO NEW YORK HARBOR.—Report of Col. William M. Black, Corps of Engineers, U. S. A., and Prof. Earle B. Phelps, submitted to the Board of Estimate and Apportionment, March 23, 1911. New York: City Doc. Paper; 7 × 10 ins.; pp. 193; two folding maps, seven plates, 13 diagrams and many tables.

MONOPLANES AND BIPLANES; THEIR DESIGN, CONSTRUCTION AND OPERATION.—The Application of Aerodynamic Theory with a Complete Description and Comparison of the Notable Types. By Grover Cleveland Loening, B. Sc., A. M. New York: Munn & Co., Inc. Cloth; 6 × 8¼ ins.; pp. 331; 278 illustrations in text. $2.50, net.

MAINE STATE WATER STORAGE COMMISSION.—First Annual Report, January, 1911, (Bert M. Fernald, Governor and Chairman). Augusta, Me.: Pub. Doc. Cloth; 5¾ × 9 ins.; pp. 373; 14 plates and one text figure.

NOTES ON PLATE-GIRDER DESIGN.—By Clarence W. Hudson, C. E., M. Am. Soc. C. E.; Professor of Civil Engineering, Polytechnic Institute of Brooklyn, N. Y.; Consulting Engineer. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6 × 9 ins.; pp. 75; numerous illustrations in text. $1.50, net.

NOTES ON SEWAGE DISPOSAL.—By C. E. Grunsky, Dr. Eng., M. Am. Soc. C. E. Reprint from the California State "Journal of Medicine," April, 1911. San Francisco, Cal.: American Engineering Corporation, Mechanics' Institute Bldg. Paper; 4¾ × 7¼ ins.; pp. 15.

POWER.—Columbia University Lectures. By Charles E. Lucke, Ph. D., Professor of Mechanical Engineering, Columbia University. New York: The Columbia University Press. Agents: Lemcke & Buechner (30 W. 27th St., N. Y.) London: Henry Frowde (Amen Corner, E. C.) Cloth; 5¼ × 8 ins.; pp. 316; 223 figures in text. $2. net.

THE PRACTICE OF COPPER SMELTING.—By Edward Dyer Peters, Professor of Metallurgy, Harvard University; Author of "Principles of Copper Smelting," "Modern Copper Smelting." New York and London: McGraw-Hill Book Co. Cloth; 6¼ × 9¼ ins.; pp. 693; 121 figures in text. $5, net.

PUBLIC WORKS DEPARTMENT (Madras Presidency).—Administration Report, 1909-10. Part II.: Irrigation. Madras, India: Pub. Doc. Boards; 8 × 13 ins.; pp. 251; one folding map; 13 diagrams. 5s. 6d., net; American price, $2.25, net.

THE PURCHASING POWER OF MONEY.—Its Determination and Relation to Credit, Interest and Crises. By Irving Fisher, Professor of Political Economy in Yale University; Assisted by Harry G. Brown, Instructor in Political Economy in Yale University. New York: The Macmillan Co. Cloth; 5¾ × 8¾ ins.; pp. 505; 20 illustrations in text. $3, net.

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RAILROAD COMMISSION OF THE STATE OF CALIFORNIA.—Report from Jan. 1, 1909, to June 30, 1910. W. D. Wagner, Secy. Sacramento, Cal.: Pub. Doc. Cloth; 5¾ × 9 ins.; pp. 281.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—Proceedings of the Annual Meeting Held in Madison, Wis., June 23-25, 1910. Vol. XVIII. Edited by Arthur N. Talbot, Henry S. Munroe, and Henry H. Norris. Ithaca, N. Y.: Henry H. Norris, Secy., Cornell University. Cloth; 5¾ × 9 ins.; pp. 457. $2.50 to non-members, $2 to public libraries, and $1.50 to members.

THE STATE GEOLOGICAL SURVEYS OF THE UNITED STATES.—Compiled under the direction of C. W. Hayes. Bulletin No. 465, Dept. of the Interior, U. S. Geological Survey; Geo. Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 177.

STATE GEOLOGICAL SURVEY, TENNESSEE.—Geo. H. Ashley, State Geologist. Bulletin No. 13: A Brief Summary of the Resources of Tennessee. For the Homeseeker, Investor, Business Man, Farmer and Others. By Geo. H. Ashley, Nashville, Tenn.: Pub. Doc. Paper; 6 × 9 ins.; pp. 40; numerous photographic views.

STATE OF MAINE.—Annual Report of the Commissioner of Highways (Paul D. Sargent), 1910. Augusta, Me.: Pub Doc. Cloth; 5¾ × 9¼ ins.; pp. 157; 11 plates and 5 diagrams.

STEAM TURBINES.—A Short Treatise on Theory, Design and Field of Operation. By Joseph Wickham Roe, M. E., M. Am. Soc. M. E., M. Am. Inst. Mining Engineers; Assistant Professor of Mechanical Engineering, Sheffield Scientific School, Yale University. New York and London: McGraw-Hill Book Co. Cloth; 6¼ × 9¼ ins.; pp. 143; one folding diagram and 71 text figures. $2, net.

TRAVAUX MARITIMES.—By A. Guiffart, Ingénieur des Ponts et Chaussées. Paris: Octave Doin & Sons (8, Place de l'Odéon). Cloth; 4¾ × 7¼ ins.; pp. 360; 75 text figures. 5 francs; American price, $1.50, net.

U. S. BUREAU OF THE CENSUS.—Department of Commerce and Labor; E. Dana Durand, Director. Washington, D. C.: Pub. Docs. Paper; 5¾ × 9 ins. Compiled in cooperation with the Department of Agriculture: Forest Service, Henry S. Graves, Forester.
Forest Products, No. 2: Lumber, Lath, and Shingles; 1909. Pp. 63; two diagrams and 44 tables in text.
Forest Products, No. 5: Veneers; 1909. Pp. 23; four tables.

[U. S.] COAST AND GEODETIC SURVEY.—Department of Commerce and Labor. Report of the Superintendent (O. H. Tittmann) Showing the Progress of the Work from July 1, 1909, to June 30, 1910. Washington, D. C.: Pub. Doc. Cloth; 9 × 12 ins.; pp. 454; nine folding maps in pocket, 40 folding plates and 10 text figures.

U. S. DEPARTMENT OF AGRICULTURE.—(Hon. James Wilson, Secy.) Farmers' Bulletin No. 453: Danger of General Spread of the Gipsy and Brown-Tail Moths through Imported Nursery Stock. By C. L. Marlatt, Entomologist and Assistant Chief, Bureau of Entomology. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 22; seven text figures.

U. S. DEPARTMENT OF AGRICULTURE.—Forest Service, Henry S. Graves, Forester. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.
Bulletin No. 87: Eucalypts in Florida. By Raphael Zon, Chief of Silvics, and John M. Briscoe, Forest Assistant. Pp. 47; five plates and one text figure; 20 tables.
Circular No. 175: The Growth and Management of Douglas Fir in the Pacific Northwest. By Thornton T. Munger, Forest Assistant. Pp. 27; four text figures and eight tables.

U. S. GEOLOGICAL SURVEY.—Department of the Interior, Geo. Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.
Bulletin 431-B: Advance Chapter from Contributions to Economic Geology (Short Papers and Preliminary Reports), 1909. Part II.—Mineral Fuels. Coal and Lignite, by Charles Butts, M. R. Campbell, F. G. Woodruff, C. T. Lupton, J. S. Diller, M. A. Pishel, H. E. Gregory, and A. C. Veatch. Pp. 163; nine folding maps and three text illustrations.
Bulletin 447: Mineral Resources of Johnstown, Pennsylvania and Vicinity. By W. C. Phalen and Lawrence Martin. Surveyed in cooperation with the Topographic and Geologic Survey Commission of Pennsylvania. Pp. 142; seven plates and 22 text figures.
Bulletin 453: Results of Spirit Leveling in Minnesota, 1897 to 1910, inclusive. By R. B. Marshall, Chief Geographer. Work done in cooperation with the State of Minnesota during 1909 and 1910. Pp. 39; one plate.

U. S. GEOLOGICAL SURVEY.—Department of the Interior, Geo. Otis Smith, Director. Water-Supply Paper 258: Underground-Water Papers, 1910. By M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 123; two plates and 32 text figures.

VERSUCHE MIT BETONSAEULEN.—By Professor M. Rudeloff, Grosslichterfelde. Vortrag Gehalten auf der XIV. Hauptversammlung des Deutschen Beton-Vereins, Feb. 14, 1911. Berlin: Wilhelm Ernst & Sohn. Paper; 6¾ × 10¼ ins.; pp. 39; 18 illustrations in text. 0.60 marks; American price, 25 cts., net.

VICTORIAN INSTITUTE OF ENGINEERS.—Proceedings, 1910; Vol. XI. Edited by Jas. Alex. Smith and Wm. Chas. Rowe. Melbourne, Australia: The Institute, 57-59 Swanston St. (D. L. Stirling, Secy.) Cloth; 5½ × 8¾ ins.; pp. 196; illustrated.

WHAT FARMERS CAN DO TO ASSIST IN THE CAMPAIGN AGAINST FLIES AND MOSQUITOES.—By Wm. Paul Gerhard, C. E., M. Am. Soc. M. E., Consulting Engineer. (Reprinted from "The Country Gentleman.") New York: The Author, 39 Strong Place, Brooklyn. Paper; 6 × 9 ins.; pp. 14. 25 cts., net.

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